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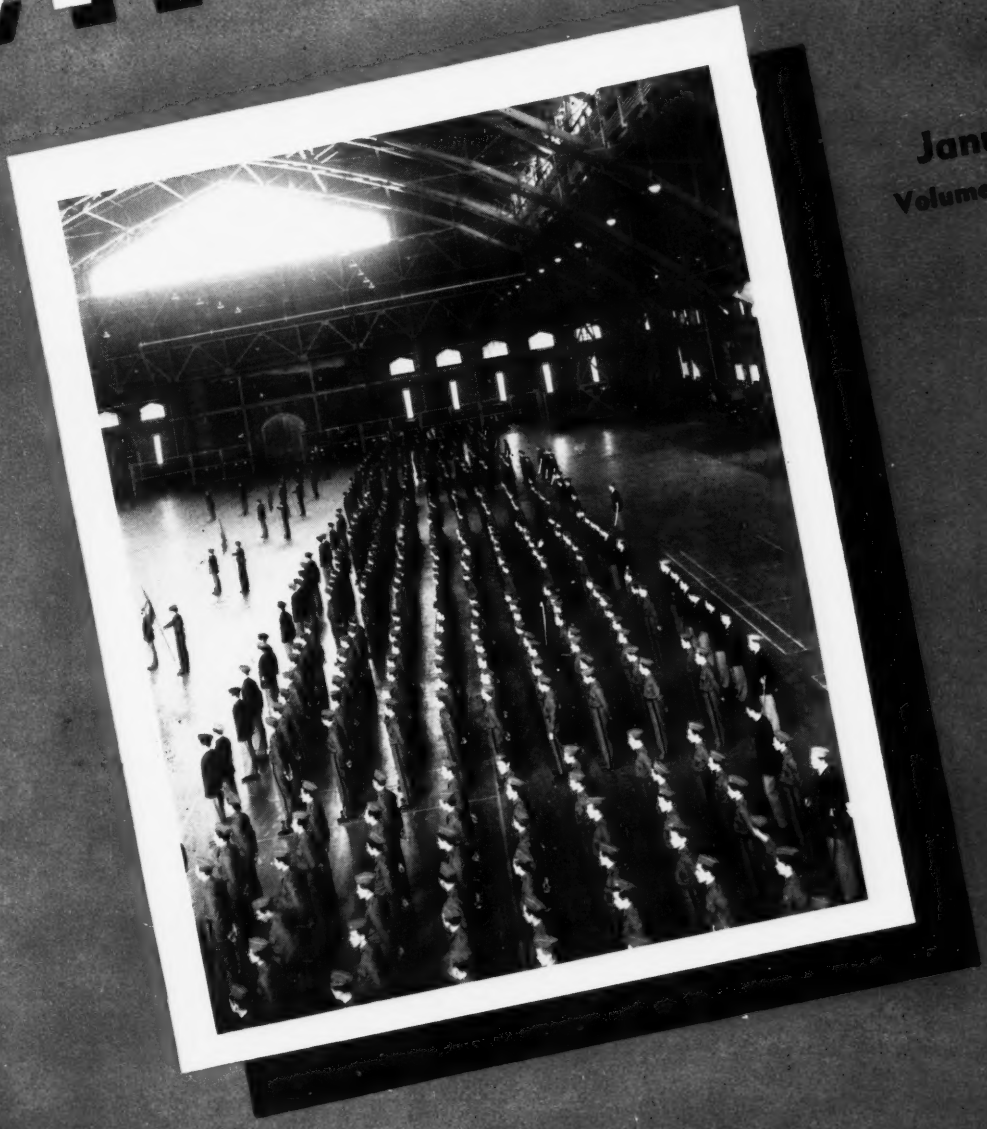

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And now, *electronics at work* are bringing victory closer every day . . . for Ignitrons with a rated capacity of more than 3,000,000 kw are turning out the thousands of tons of aluminum and magnesium upon which our Arsenal of Democracy depends!

* * *

WE SALUTE DR. ASHCRAFT and the other thousands of scientists who are working for victory in research laboratories all over America.

We also salute the scientists of tomorrow . . . the engineering students now in college who will be called upon to rebuild a war-torn world.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pennsylvania.

TOM THUMB CHEMISTRY . . . Dr. E. Bruce Ashcraft examines a specimen weighing less than a microgram . . . approximately 1/50th the size of a grain of ordinary table salt. Dr. Ashcraft received his B.S. at Texas A & M, and his Ph.D. at Cornell University in 1937.

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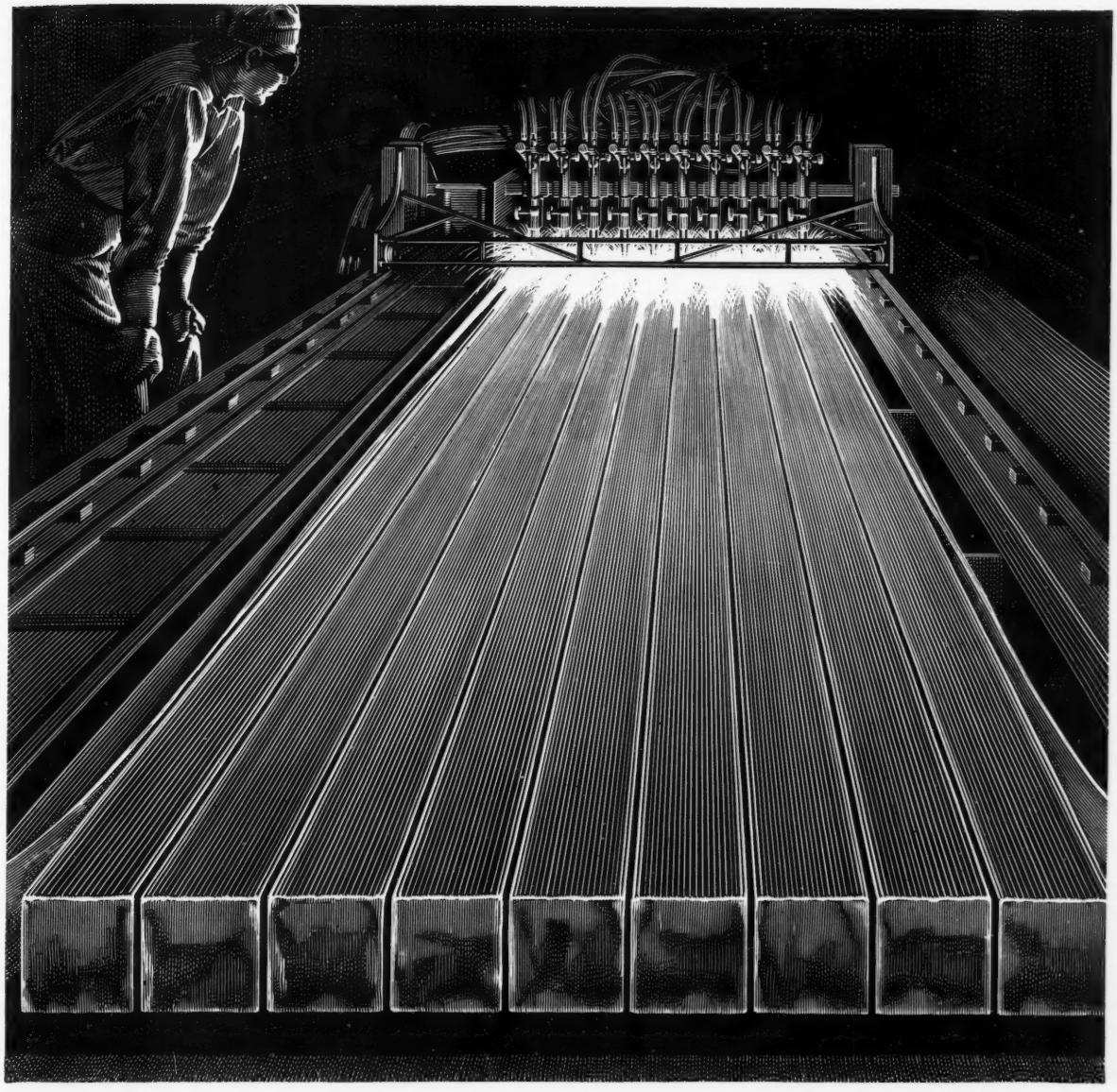

SLICING STEEL SLABS — and production schedules

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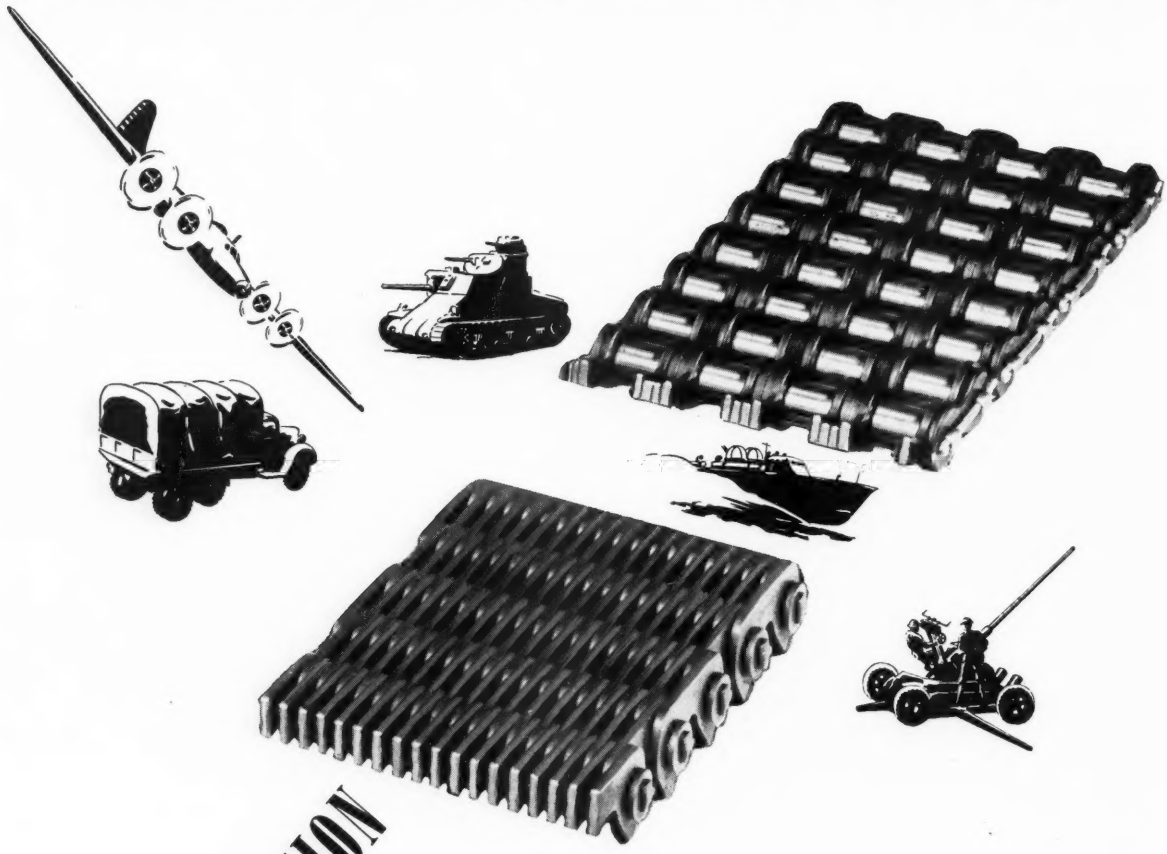

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—Courtesy Cornell Alumni News

Color Guard of the Pershing Rifles, crack drill squad of the Cornell R.O.T.C.

R.O.T.C. Training At Cornell

This article was written especially for the CORNELL ENGINEER by the military department at Cornell. It describes the setup of the various divisions of instruction at Cornell and their relation to the war effort.

PRIOR to the passing of the National Defense Act, the military policy of the United States had never crystalized to the extent that the country was assured of a reasonable protective military force.

The National Defense Act provided, among other things, for the establishment of a Reserve Officers' Training Corps. According to the Act, the mission of the Corps was to provide a reservoir of trained Reserve officers who, in time of emergency, could be called into the Federal service for active duty. Based on the authority of the National Defense Act, certain colleges were selected by the War Department at which R.O.T.C. Units were to be established. These colleges are today operating and maintaining R.O.T.C. Units; students of these colleges are receiving military instruction and training. This instruction and training is divided into two distinct divisions: that given in the Basic Course and that given in the Advanced Course.

Charactertistics of the Basic Course:

The Basic Course covers the Freshman and Sophomore college years. From the military standpoint, its primary mission is the instillation of discipline and respect for proper authority, the appreciation of citizenship and its obligations, physical development and a foundation for such technical military training as would be required in the training of a noncommissioned officer.

Characteristics of the Advanced Course:

The Advanced Course is composed of specially selected students who have completed the Basic Course. Their selection is based of their intelligence, ability, the potential qualifications of leadership and other qualifications necessary for a commissioned officer.

Types of Colleges:

The colleges maintaining R.O.T.C. Units may be divided into two distinct categories: one requires the completion of the Basic Course by all physically fit male students, the Advanced Course being "elective" with the students. The other type places R.O.T.C. on an "elective" basis for both Basic and Advanced Courses. In either type, approval of application by a student to enroll in the advanced course must be obtained from the Military Department prior to enrollment.

Academic Credit:

The amount of academic credit given the Basic Course varies materially among the colleges which have R.O.T.C. Units established therein. Where "full academic credit" is given the Basic Course, the R.O.T.C. is normally on a "science" basis, which means it is given the same academic credit as other "sciences" and requires the same number of hours attendance as does any other "science" taught in the college. The Basic Course in colleges giving this credit is superior to that given in colleges which give limited credit or none at all. For example, in a college giving full academic credit to the Basic Course, the subject of "Motors" is extensively covered to include such subjects as "Internal Combusion Engines", "Basic Principles of Electricity and Ignition" and so forth. In a college giving limited or no academic credit, these subjects, if given at all, can only be covered in a prefunctory manner. In general, all colleges give full academic credit on a "science" basis to the Advanced Course. The Advanced Course concentrates on subjects which must be known by all commissioned officers. In general, it requires hours of study compatible to other subjects offered by the college or university.

Types of Units:

In the larger colleges, the R.O.T.C. Unit will have several arms or services represented. For example, Cornell maintains within the R.O.T.C. Unit a Field Artillery Unit, Signal, Ordnance and Quartermaster Units. The establishment of these types of units is possible due to the large student enrollment, coupled with the varied instruction given at the University.

Field Artillery Unit

The Field Artillery Unit is the largest at Cornell: most "Basics" are in Field Artillery, and the Advanced Course registration exceeds allotments in the other units.

When the Freshman enrolls in the Basic Course, he obtains a threefold benefit. His physical development is encouraged, the obligation of citizenship is impressed upon him, and he is given the fundamental training of a Field Artilleryman. Freshman R.O.T.C. makes for the physically fit, mentally equipped citizen who may, in time of emergency, serve his country as an enlisted man.

Each entering Freshman is as-

signed to a battery. He studies military fundamentals, military organization and organization of the Field Artillery, map reading, leadership, Field Artillery instruction, and military discipline, courtesies, and customs of the service.

He learns to square his shoulders and carry himself erect in the "military" manner which every citizen might well have. The neatness, promptness in keeping engagements, and the courtesies of the service impressed upon him are useful daily in civilian or military life.

From the academic point of view, the Freshman receives instruction in American History as it has been affected by our military policy. He learns that our national welfare has suffered from the lack of a sound military policy, and is taught that the American citizen has, in the National Defense Act and the R.O.T.C., a military policy fashioned for practical purposes consistent with our democratic ideals.

In technical subjects, the Freshman learns to use maps, execute close order drill, and to serve as a cannoneer. At the end of his first year, the Freshman should know, and be able to teach the elementary duties of the Field Artillery soldier.

The Sophomore broadens his knowledge of Field Artillery until he is qualified to perform the duties of a noncommissioned officer. He has an option, Equitation or Motors, which fills one term. In Equitation, he learns the care of animals and stable management. In Motors, he studies automotive vehicle construction, operation, and practice.

For the second term, the Sophomore studies the Battery Detail, concentrating on "Instruments and Communications". This instruction is highly technical and fits him to become a noncommissioned officer, or a key man in the Battery Detail. His final training in this course coordinates the use of instruments and communications (in so far as the Battery Detail is concerned).

Hence, upon completing the Basic Course, (the Freshman and Sophomore years) the R.O.T.C. student has been trained to perform the duties of a noncommissioned officer, often referred to as the keystone of the well-trained army.

While the Basic Course ends with the Sophomore year, the military education of the young man who has done his work well and is anxious to continue has only begun. He must still be trained as an officer.

Throughout the Basic Course, the student has been constantly observed and studied by his instructors. Late in his Sophomore year, his good work bears its reward. On his military work, his standing in the University, personality, and extra-curricular activity, he is invited to take the Advanced Course because he appears to have "outstanding qualities for leadership and command."

Before him lies two more years of study and, after graduation, a period of practical training at the Field Artillery School, Fort Sill, Oklahoma. After his practical training at the Field Artillery School, he will receive his commission as second lieutenant, Army of the United States.

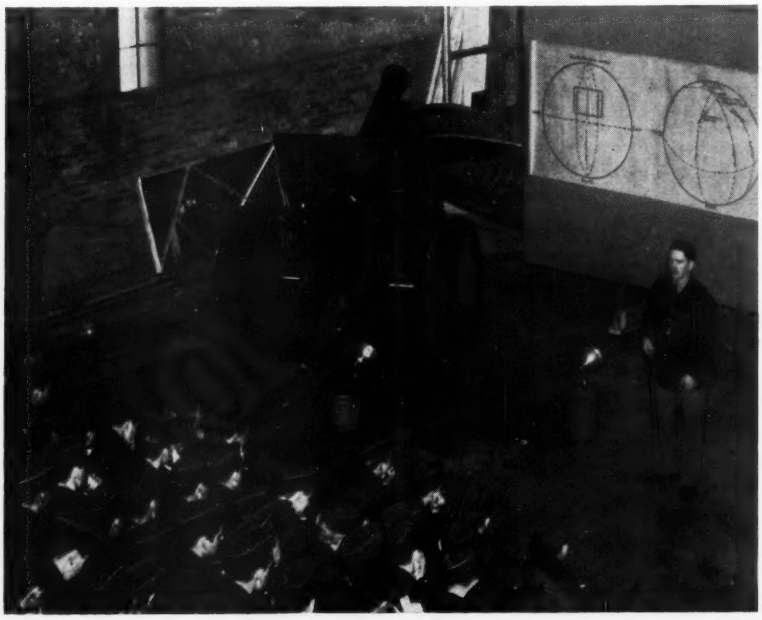
A two-fold objective constantly urges him on in the Advanced Course. First, he must obtain the technical training to fit him as an officer. Second, he must remember that what he is learning, he must be able to teach to others.

As a Junior, he spends many hours afield on battery reconnaissance and occupation of position. On his thorough knowledge of this phase of Field Artillery depends the speed with which he places his battery in proper firing position. He has his first real opportunity to instruct, for part of the training of Basic Course students is now entrusted to him. He expands his knowledge of military motor vehicles, studies battery administration, defense against chemicals, aerial photograph reading, and above all, gunnery.

The ultimate object of every Field Artillery officer is to conduct fire. Knowledge of every other subject leads but to that goal. The junior course in gunnery embraces a theoretical and practical study of elementary ballistics and dispersion, preparation of fire, conduct of fire, and survey operations and procedure. Once through his gunnery, the Junior should be able quickly and accurately to bring fire upon the enemy, thereby fulfilling the Field Artillery mission of supporting other combat arms.

In his Senior year, the student

Freshmen receiving a lecture on map making.



has the growing urge to wear those gold bars, but more hours of that preparation needed by the officer await him. He studies tactics to learn the composition and use of other military units, while a course in advanced gunnery and fire direction reinforces his Junior gunnery. He studies military law and property emergency procurement, and funds, but most important, he studies methods of instruction and applies those principles of teaching through the Cadet Commission which may place him in command of a Freshman battery similar to that of which he was a member four years before. Thus he develops those qualities of leadership which will enable him to become a commissioned officer in a combat unit.

After graduation, the Senior is ordered to the Field Artillery School as an officer candidate. At "Sill" he puts to practical use his theoretical college training. At long last comes his commission with its gold bars and assignment to duty in ultimate fulfillment of that fundamental obligation of the citizen of a democracy—skilled defense of his country in time of need.

Signal Corps Unit

Instruction in the work of the Signal Corps now being given in the R.O.T.C. at Cornell University emphasizes in so far as possible the practical application of communication equipment and its use in field systems. Every effort is being made to obtain maximum results in the time available for instruction. For the first and second year Basic courses this time element consists of weekly periods of three hours each. The first and second year Advanced Course students have four hours per week of R.O.T.C. instruction.

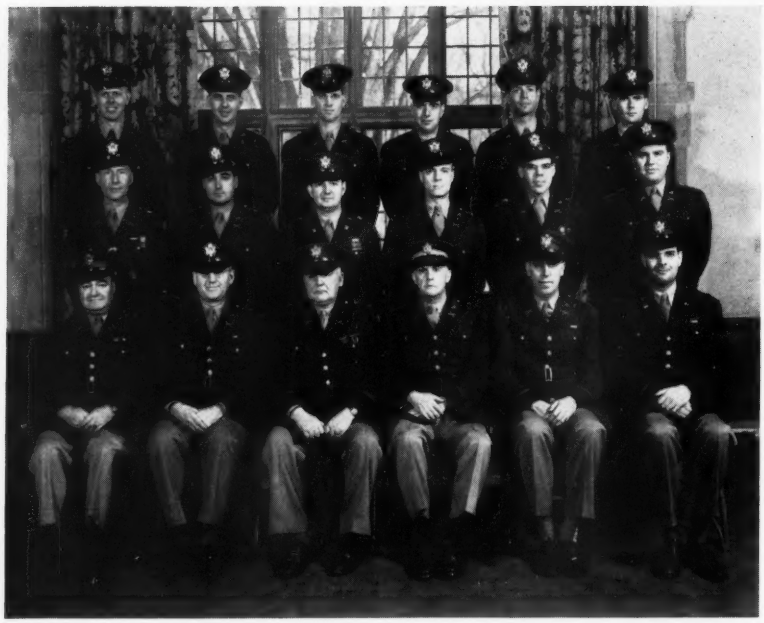
In the first year Basic Course certain subjects are briefly covered in common with the field artillery unit. These include orientation, obligations of citizenship, military history and policy, military discipline, courtesies and customs of the Service. The Signal Corps instructors give the courses in organization, and signal communication for all arms and services, map reading, wire communication, and leadership. Of these latter courses, the fundamentals of organization, map reading, wire communication and leadership are the most important and are given the greater emphasis. At the completion of this first year Basic Course, the student should be capable of correctly interpreting maps, know how to operate telephone switchboards and have a basic understanding of the wire equipment associated with the field systems of the combat units of any army division. The leadership course covers various phases of close order drill and the school of the soldier. The student meeting the objectives of the first year Basic Course is qualified to assume the responsibilities of a noncommissioned officer.

Having learned something about the practical side of the use of wire equipment and wire field systems in the first year, the student is given courses in the second Basic year in radio materiel and radio field systems. Again the practical side is emphasized and the student is given a brief working knowledge of radio as a means of communication in the army. Corollary courses in code practice and radio procedure are given in this year. While time is not available for thorough training in this category, a basic knowledge of the problems involved is attained. One hour per week of leadership training further develops the student's ability to act as a noncommissioned officer in the service.

The following subjects are covered in the first year Advanced Course: organization of the infantry division, wire communication, radio communication, signal communication tactics, administration, aerial photograph reading, homing pigeons, and leadership. Wire and radio communication are given more with the objective of qualifying the student as an efficient instructor in these subjects upon becoming an officer. The course in signal communication tactics covers the preparation of all types of signal orders, standard operating procedure, signal operation instructions and gaining a basic knowledge of the duties and responsibilities of the signal corps officer engaged in operations. As this is the formative year for the student's training as an officer, exercises in voice and command and the development of a forceful, positive personality and presence are the emphasized phases of leadership training during the first year Advanced Course work.

The last two terms of Signal Corps R.O.T.C. training, comprising the second year Advanced

Advanced Field Artillery practicing gunnery.



—Courtesy Moser Studio, Rochester, N. Y.

Staff of the military department.

Top row, left to right: Capt. Bradley, Captain Jones, 2nd Lt. Miller, 1st Lt. Downing, Capt. Cowen, Capt. Blatz.

Middle row: 1st Lt. Sturm, 1st Lt. Clark, Maj. Halbleib, 1st Lt. Murdock, 2nd Lt. Stack, 1st Lt. Pearson.

Bottom: Lt. Col. Matthews, Maj. Huske, Col. Van Deusen, Lt. Col. Reigner, Maj. Schaefer, Maj. Dodge.

Course, cover a variety of subjects intended to round out the student's training and experience to qualify him as a reserve officer. The subjects having the major emphasis in this important training phase are a continuation of signal communication tactics, including the practical solution of tactical problems, a course in training management and a course in elementary cryptography. In the leadership training, the students get as much practice as possible in acting as instructors of the Basic students. Short courses in signal supply, motor transport and operations are given by the Signal Corps. Certain courses are given in common with the other branches of the service represented, including property and funds, military law and Officers' Reserve Corps regulations.

Upon completion of the eight terms of college work, the student is then ordered to Fort Monmouth, N. J., to take a concentrated course of six weeks duration comprising the Basic Course of the Officers' Candidates School. Here the student gets actual training in the field with modern signal equipment and the arms used by the Signal Corps. Upon successful completion of this phase, the student is commissioned second lieutenant in the Officers' Reserve Corps and, of course, under present wartime conditions, ordered to immediate active duty as an officer of the line in the Army Signal Corps.

It is interesting to note that every recent Cornell graduate product of the Signal Corps course heard from by this headquarters has been given a responsible position and are progressing extremely well. Several have been in many months' overseas service with the aircraft warning service and other signal units. Some are instructors in the Officers' School at Monmouth. One graduate of the Class of 1941 is a captain in the Chief Signal Office in Washington. This progress, needless to state, is very gratifying to the staff of the R.O.T.C. here at Cornell.

Quartermaster Unit

The "Fighting Quartermaster" is the "Jack of All Trades" in the Army today. His duties and responsibilities include the procurement, storage, and issue of all supplies of standard manufacture and of all supplies common to two or more arms or services, except motor vehicles. The maintenance and operation of Quartermaster transportation is an important phase of his work. The movement of supplies and troops, the operation of the Army Transport and Harbor Boat Service is included in his sphere of activity. He operates the General Service Pool, the stevedore service and the docks. Operation of bakeries, sales commissaries, laundries, textile and shoe repair, sterilization and bath, refrigeration and salvage centers allow the Arms the full completion of their objective — "Victory". He supervises and trains basic motor and supply presonnel. The graves registration service is an integral part of his duties. The Remount Service processes, trains, classifies and distributes all animals to the Army. The operation of the Subsistence School, the Schools for Cooks and Bakers, is under the Quartermaster General. The Quartermaster School at Camp Lee, Virginia, trains officer candidates, specialists, and gives advanced officer training in Quartermaster activities.

There is no Basic Quartermaster Course given at Cornell. Advanced Course students select the Advanced Course Quartermaster after completing the Basic (Freshman and Sophomore) Field Artillery Course.

The Quartermaster Corps Advanced Unit at Cornell concentrates on qualifying the student for a commission as Second Lieutenant in the Quartermaster Corps, in the Officers' Reserve Corps, Army of the United States. The latter phase of his training will be completed at the Quartermaster School, Camp Lee, Virginia.

The first year of the Advanced Course embraces a number of subjects. Organization of the Army deals with the general administrative and tactical schemes of the Army. The student must possess a knowledge of Company Administration which includes military correspondence, personnel records, rations and payrolls. The prob-

(*Continued on page* 30)

O.P.A. Fuel Oil Rationing Plan

By CHARLES O. MACKEY, M.E. '26

Professor of Heat Power Engineering

Director of Mechanical Engineering Laboratory

THE allowable ration of fuel oil is based, in part, upon a formula which includes the heated floor area, the normal number of degree days in the heating season, and a numerical constant.

There are certain terms used by the U. S. Weather Bureau important in understanding the rationing plan. The *daily maximum temperature* is the highest temperature recorded by a station on a given day in a given year, and the *daily minimum temperature* is the lowest. The *daily mean temperature* is the arithmetic mean of the daily maximum and daily minimum temperatures. For example, on November 28, 1942, the maximum temperature recorded at the New York City (Battery Place) station was 41°F, the minimum was 27°F, and the mean 34°F.

The number of degree days per day is the difference between 65°F and the daily mean temperature, when the latter is less than 65°F. Thus, on November 28, 1942, there were (65-34) or 31 degree-days reported by the New York City Weather Bureau. The amount of heat that must be supplied daily by a heating plant in buildings that require an indoor air temperature of about 70°F has been found by experience to be approximately proportional to the number of degree days per day.

There are some reasons why this should be true and other reasons why it should not hold precisely. Theoretical study indicates that, if the temperatures are periodic with a period of 24 hours, the rate of daily heat loss from a structure by direct transmission of heat through the building materials, exposed to outdoor air on one side and indoor air on the other, is proportional to the product of the over-all coefficient of heat transfer and the difference between the integrated mean of the indoor air temperature and the integrated mean of the outdoor air temperature (this is true even with unsteady heat flow). The Weather Bureau mean temperature is not the integrated hourly mean of the outdoor air temperature. If one were to continuously record the temperatures of the outdoor air for 24 hours, integrate the area of this curve below a base temperature of 65°F, and divide the area by 24, he would not always get the same mean temperature as that reported by the Weather Bureau. The base temperature of 65°F is not the integrated daily mean temperature of the indoor air. For example, if a room is kept at a temperature of exactly 72°F for 16 hours, and exactly 60°F for 8 hours, the true daily mean temperature of the indoor air is 68°F. The value of the over-all coefficient of heat transfer does not remain constant at all times, since it is influenced by wind velocity. The degree-day method of estimating fuel consumption includes no allowance for the direct effects of solar radiation. Part of the loss of heat from a structure is caused by infiltration of cold outdoor air around window and door cracks on the windward side and exfiltration of heated indoor air on the leeward side of the building. Such heat loss is influenced considerably by wind velocity, and this effect is not included in the degree-day method. A small part of the heat lost from the usual structure is transferred to the ground, and this is not considered in the degree-day method. In some ways, it is quite surprising that the degree-day method works at all; for a complete heating *season,* of course, the results are more accurate than for a single day. As a matter of fact, the actual quantity of heat lost from a structure per Weather Bureau degree-day is appreciably greater on a day when there is little or no sun and a high wind velocity than it is on a day when there are many hours of sunshine and a low wind velocity.

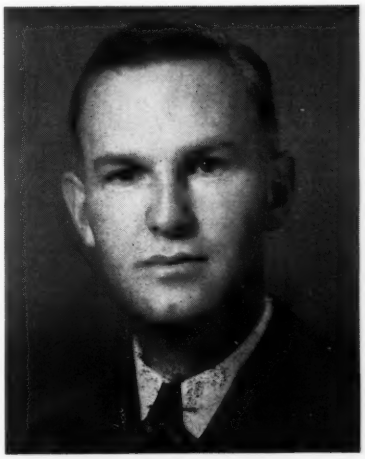
Formula Factors

The heated floor space includes only necessary living, sleeping, and working space. It does *not* include

THE AUTHOR

OVER seventeen years ago Professor Charles O. Mackey started teaching at Cornell. That was two years prior to his graduation from Sibley College in 1926. Since that time he has advanced rapidly in the Heat Power Department, being made a full Professor in 1936.

Aside from his teaching duties, he has done considerable work as a consultant in air-conditioning and refrigeration. He has worked for the Detroit Edison Company, Eastman Kodak Company, and the Carrier Corporation.



Professor C. O. Mackey

basement space, laundries, sleeping porches, sun porches, garage space, recreation rooms, workshops, attics, or storage space other than closets that open directly into heated living, sleeping, or working space. The *maximum* floor area allowable as heated space depends upon the number of occupants of the dwelling. For one occupant, the maximum is 2000 sq. ft., for two or more occupants, the maximum allowance in sq. ft., is [2000 + 300 (number of occupants)]. Thus, for four occupants, the maximum floor area allowable as heated space is 3200 sq. feet.

In order to give approximately equal comfort from the rationed supply, regardless of climate, the country is divided into four primary thermal zones. Within each of these zones, the average normal temperatures of the outdoor air (or the number of degree-days) in the heating season are somewhere near the same. Each zone is further subdivided into districts of more nearly equal winter temperatures. Thus, Tompkins County and Bronx County are in Thermal Zone B, but Tompkins County is allowed more fuel oil per sq. ft. of heated floor area than is Bronx County.

The numerical constant in the rationing formula is based upon a standard coefficient of heat loss loss from the dwelling and upon a standard efficiency of the heating plant. These standards are intended to be high enough to force improvements in poorly insulated structures or inefficient heating plants in order to insure reasonable comfort with a 33⅓ percent cut in fuel. At the same time, fuel reductions of as low as 15 percent are allowed where the dwelling already has a low coefficient of heat loss and an efficient heating plant.

Two constants are used in the fuel rationing formula to give the maximum and minimum rations. For example, a dwelling with a central heating plant is allowed, during a normal winter, a maximum ration of 1.25 gallons per sq. ft. of heated floor space in Tompkins County and 0.982 gallons per sq. ft. of heated floor space in Bronx County. The corresponding minimum rations are 0.959 gallons per sq. ft. in Tompkins County and 0.753 gallons per sq. ft. in Bronx County.

1941-42 Consumption

The total consumption of fuel oil during the heating season of 1941-42 is another factor in the rationing plan. If fuel oil was used for domestic water heating, a deduction is made from the total consumption to estimate the fuel used for space heating only. The monthly allowance for deduction for hot-water heating from the 1941-42 consumption is [15 + 5 (number of occupants)] gallons. Thus, with four occupants, the allowable deduction is 35 gallons per month. After this deduction is made, the 1941-42 consumption for space heating is adjusted to a *normal* heating season. In Tompkins County, for example, this adjustment to the normal season allows an increase of 7 percent; in Bronx County, the increase is 11 percent. This is done because the 1941-42 heating season was milder than normal. The regular base consumption for *space heating* in the *normal season* is then found by taking two-thirds of the adjusted 1941-42 consumption. To this regular base consumption is then added a monthly allowance for domestic hot-water heating of [10 + 3⅓ (number of occupants)] gallons, if oil is used for this purpose. Note that this regulation cuts the oil available for water heating, as well as for space heating, by one-third.

If the regular base consumption for space heating in the normal season falls between the minimum and maximum limits of the ration formula based on heated floor area, the result is the ration. If it exceeds the formula maximum, only the formula maximum is allowed. If it falls below the formula minimum, the ration is the formula minimum, or 85 percent of the adjusted 1941-42 consumption, whichever is the smaller.

Special additional allowances may be granted for families in private homes with children under four years of age or for private homes in which there are ill or aged persons. For children under four years of age, the additional allowance is 125 gallons in thermal zone A, 100 gallons in zone B, 75 gallons in zone C, and 50 gallons in zone D. Supplemental rations for ill or aged are determined by the rationing board on the basis of a physician's statement.

Table I

Dwelling	Description	Total Consumption of Fuel Oil in 1941-42, gallons	Allowance for water heating in 1941-42 (12 months, 4 occupants), gallons	Net consumption for space heating in 1941-42, gals.	Adjusted Consumption for space heating in normal season, gallons	Economy Consoumption, Gallons	
						Regular Base	Special Base
		(1)	(2)	(3)=(1)—(2)	(4)=1.07(3)	2/3(4)	0.85(4)
A 1800 sq. ft. heated floor space	Well insulated, weather stripped, efficient heating plant	2400	420	1980	2119	1412	1801
B 1800 sq. ft. heated floor space	Average construction, standard heating plant	3100	420	2680	2868	1912	2437
C 1800 sq. ft. heated floor space	Poor construction, inefficient heating plant	3800	420	3380	3617	2411	3074

The rations are based upon a normal winter. In the event of a considerable department from normal conditions, the value of each rationing coupon, in gallons of fuel oil, may be changed.

How The Plan Works

The arithmetic of the rationing may be explained by three illustrative examples. Each example is an assumed private home in Tompkins County occupied by two healthy adults, one healthy child over four years of age, and one child under four. In each dwelling the heated floor space is assumed to be 1800 sq. ft. (Note that this is under the maximum allowance of 3200 sq. ft. for four occupants.) In each home, there is a central heating plant, and fuel oil is used for space heating and domestic hot-water heating. Water is heated twelve months of the year.

The numerical examples illustrate

how the owner of a well-insulated home in which fuel oil has, in the past, been burned very efficiently will incur a fuel cut of less than one-third, while the owner of a flimsy structure equipped with an inefficient heating plant will *suffer* a fuel cut of more than one-third. The plan does not aim to assure the same comfort in each dwelling unless steps are taken by the owner to bring the insulation of the structure and the efficiency of the heating plant up to a reasonable standard.

The methods widely advocated for saving fuel comfortably all involve, as variables, temperature, time, space, and, a fourth dimension, clothing. There is little experimental evidence upon which to base any sweeping conclusions concerning the effect of lowered indoor air temperature upon health. Reage. Normal children over four need a cooler, not a warmer, environment than adults. Older people, particularly those of lower vitality, need a temperature not less than 70°F, and possibly not less than 74°F. Consideration should also be given to individual differences.

The possible saving in fuel due to reduction of indoor air temperature, only, is not without limit if comfort is to be maintained. In Ithaca, for example, the mean normal temperature of the outdoor air in the period from October 1 to May is about 35°F. The rate of heat loss from an enclosure is substantially proportional to the difference between the temperature of the indoor air and the temperature of the outdoor air. "Time" must be tied to "temperature" in the economy schedule as follows. If, in the past, the day setting of the thermostat has been 70°F for 16 hours and the night setting 60°F for 8 hours, an economy schedule of day setting of 65°F for 14 hours and a night setting of 55°F for 10 hours might be expected to save about 18 per cent fuel from October 1 to May 1 in a normal season.

If all the occupants are going to be gone from the home for appreciable lengths of time, additional saving may be effected by reducing the setting of the thermostat to 55°F or even 50°F. This procedure is limited, also, because the house will be slow to warm up in cold weather upon the owners' return unless the heating plant has considerable excess capacity.

In this connection, instead of operating with a constant day setting of the thermostat throughout the entire heating season, it is desirable to operate with a slightly lower temperature of the indoor air when the outdoor air temperature is high and with a slightly higher indoor air temperature when the outdoor air temperature is low. The rate of heat loss from the human body is affected by the temperature of the solid surfaces within the room as well as by the air temperature. As the temperature of the outdoor air drops, the temperatures of the inside surfaces of exterior walls and of windows also drop. In the room of average shape, exposure, glass, and construction, the temperature of the indoor air should be increased about 1°F for each 25°F drop in the temperature of the outdoor air for the same rate of heat loss fro mthe body.

Heated space enters any economy program, also, because it may be possible to shut off the heat in an unoccupied room. If the door to this room is kept closed, the rate of heat loss from this room may be cut by 30 to 40 percent. If this room is one of eight in a home, an additional fuel saving for the entire home of 4 or 5 percent may result.

Increased weight of clothing cuts down on the rate of heat loss from the human body in a given environment. It has been determined that women wearing the same weight of clothing as men experience about the same feeling of warmth in a given environment. The double standard of comfort, a perpetual headache to air-conditioning engineers, is due entirely to the double standard of clothing weight.

Allowed Rations for Normal Season:

Table II

Dwelling	Allowed for space heating, gallons	Allowed for water heating (12 months, 4 occupants), gallons	Allowed for child under four, gallons	Total Allowance for normal season, gallons
A	1726	280	100	2106
B	1912	280	100	2292
C	2250	280	100	2630

Table III

Actual Reduction in Fuel Oil for Space Heating in Normal Season:

Dwelling	Reduction in fuel for space heating, per cent
A	18.5
B	33.3
C	37.8

Table IV

Formula Rations for Space Heating in Each Home (1800 sq. ft. heated floor space, Tompkins County)

Minimum Ration for Normal Season, gallons	Maximum Ration for Normal Season, gallons
1726	2250

Table V

Location	Minimum Emergency Temperature of Indoor Air
Private homes, apartment houses, department stores, office buildings	60°F. to 68°F. (majority opinion 65°F.) subject to local regulations or codes
Schools	60°F. to 70°F. (majority opinion 65°F.) subject to local regulation or codes
Hospitals and sanatoriums	68°F. to 80°F. (majority opinion 70°F., except operating rooms 80°F.)
Sleeping rooms	50°F. to 55°F.

ducing the temperature of the indoor air below that maintained throughout the same hours of the day during other heating seasons will save fuel. The amount of fuel saved is determined by the reduction in indoor air temperature. The October 3 issue of "The Journal of the American Medical Association" suggests the *minimum* temperatures for emergency requirements as shown in Table V.

The "Journal" also recommends temperatures of not less than 70°F for children under four years of

Geophysics In The Oil Industry

By JACK H. McMINN, CE '44

AT THE time of this writing I have been informed by my former employer of his latest bit of hard luck. He has drilled another dry-hole. How much of a guessing game is this business of oil well drilling and what are the more recent developments which are eliminating its former trial and error methods?

In the beginning the romance of a driller's life attracted many men and it made of them millionaries and paupers according to their luck and intuition. Now romance in any line of endeavor adds zest, but the hard life and often hard luck of wildcatters was more than many men wished to endure. So a search for some satisfactory means of analyzing the sub-surface before it was drilled was initiated. The answer was found in the science of seismology.

Seismology was first used for investigating motions of parts of the earth relative to other parts. It has proven valuable both for the purpose of predicting earthquakes and for recording their intensities.

Geologists have long known that oil occurs under restricted conditions. An oil "pool" is not an open underground lake, but it consists of a porous rock more or less saturated with oil. Hence a porous reservoir rock (usually a sandstone or limestone) is necessary. Source rocks (usually shale beds containing organic matter) must be present in the area. An impervious rock must lie above the porous reservoir rock to act as a cap for the well.

In order for oil to accumulate in large enough quantities to be of interest economically its flow through the porous rock must be restricted by some formation which will concentrate it in a small area. Oil is usually accompanied by gas and water and as it flows the least dense (the gas) rises to the surface while the most dense (the water) settles to the bottom.

There are several geologic structures or rock deformations which result in a local accumulation of oil and gas. The more important of these formations are the dome, the anticline, and the fault. The problem of geophysical prospecting is to find such existing structures and analyze them with regard to the possibility that they may serve as gas and oil traps.

The gravitational method is based on measurements at the surface of small variations in the gravitional field. These small distortions in the gravitational field over the surface of the earth are the result of lateral variation in the distribution of the mass making up the earth's crust. Hence, if geological movements occur which involve rocks of different densities, the resulting irregularities in mass distribution will make a corresponding variation in the intensity of gravity at the surface. Sensitive instruments capable of measuring these slight variations have been devised. From this gravity variation data the probable mass distribution is determined and this is made the basis for determining geologic conditions and the presence or absence of traps favorable for the accumulation of oil.

Magnetic methods are based on measurements at the surface of small variations in the distribution of magnetized or polarized rock. Most sedimentary rocks are nearly non-magnetic, but underlying igneous or basement rocks are slightly magnetic. Thus any movement of underlying rock can often be detected at the surface by determining these magnetic variations. A sensitive magnetometer is used to measure the relative values of magnetic intensity. These are used to analyze sub-surface structures in order to locate structures favorable for the accumulation of oil.

The seismic method of exploration takes advantage of the wide differences in the acoustic properties of plastic and granular matter on the one hand and rigid or consolidated matter on the other. Non-rigid material, such as clay, sand, or gravel transmits wave disturbances, commonly called sound waves, at velocities of 1,000 to 6,000 feet per second. Rigid materials, such as rock or crystalline matter, transmit such disturbances at 16,000 to 20,000 feet per second. This affords a means of measuring that property of sub-surface materials known as rigidity.

The equipment in prospecting geophysically for oil is rather elaborate. The two main units are the recording truck and the firing truck. The recording truck contains the pickups or detectors, amplifiers, batteries, wire reels, the camera, the field telephone, and various other accessories. The firing truck contains explosives, the firing box, and a telephone for communication with the recording truck. A drilling truck and a water car are often included. This extensive equipment is justified since its use often leads to the discovery of large oil deposits.

Seismic Exploration

There are two common methods of seismic exploration known respectively as reflection shooting and refraction shooting. In the former the waves reflected by underlying strata are studied, while in the latter the refracted waves are studied.

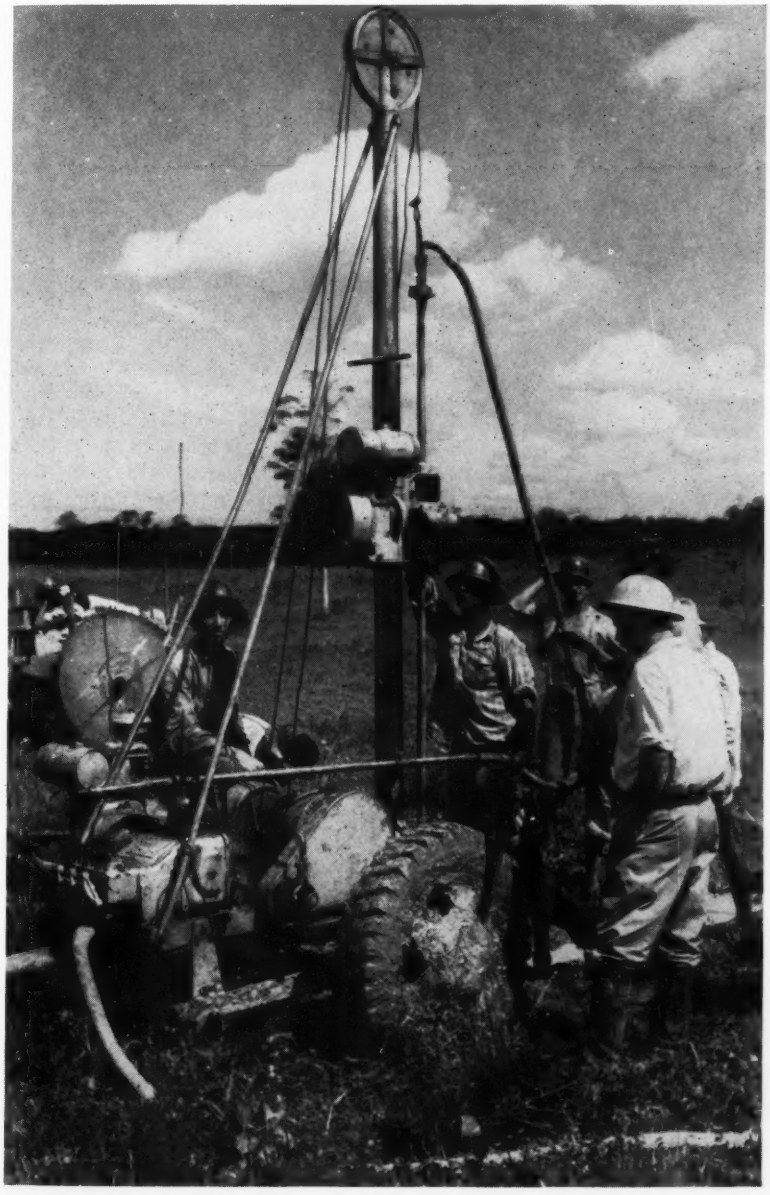
Refraction shooting is the more easily explained process and will serve to illustrate the principles of both methods. In this method a blasting cap or some other type of small discharge is set off at or just below the surface of the ground. This discharge becomes the center of a near-spherical wave front which moves outwards in all directions from this initial point. A line of equally spaced detecting devices are placed at the surface over the point discharge. The successive wave front impulses are picked up by these detectors and the impulses are carried by wire to galvanometers. The galvanometers measure very accurately the current im-

pulses initiated at the detectors by the wave fronts. The galvanometer deflections are recorded as light traces on a moving photographic film. A small wire around the discharge leads to the galvanometer. When this wire is broken by the explosion the time of the explosion is also recorded on the film traces. By counting the time units between the initial kick and the arrival of each wave at the detectors, it is possible by reasonable simple calculations to determine the average velocity of wave propagation from the shot point to the detectors. The underlying structure is then analyzed fairly easily and accurately.

Electrical Analysis

There are also several electrical methods of analyzing the underlying strata after the hole has been drilled. These make possible an accurate determination of the presence of oil and gas and also make possible a correlation of strata. Other electrical measurements give information on temperature, source of fluids present, and what processes are taking place far below the surface. The measurements made in these tests are affected by the electrical conductivity of the earth at a depth that depends on the lateral spread of the conductors or electrodes by which the currents are set up. Changes with the depth in the electrical quantities so measured are interpreted in terms of the depth to lithologic discontinuities which affect the electrical characteristics of the rocks. Several electrical methods have been devised and proven valuable in searching for minerals at shallow depths but such methods have proved impractical in searching for deeper lying oil strata.

Portable drill being used by South American reconnaissance party.
—Courtesy Oil and Gas Journal



The application of electrical methods to measurements in wells is of great interest and importance to the oil industry. Measurements are made at the surface of the current and potential of a set of electrodes lowered into the well. This gives an accurate method of detecting the presence and vertical position of oil and gas, and also the correlation of strata. Other electrical measurements give information on temperature, on source of fluids present, and on what processes are taking place far below the earth's surface.

These different methods serve quite a different purpose in geophyiscal prospecting. For example, a general reconnaissance of a large area may be made by gravity or magnetic methods. Interesting indications from such a survey then can be tested by much more expensive but often more certain seismic methods.

In general, rapid reconnaissance exploration is inexpensive and gives one general and often indefinite information. Well planned exploration work results in an amount and in a certainty of subsurface information proportional to the cost. At the present time the major oil companies maintain geophysical laboratories. Here mud samples from geophysically explored fields are analyzed and research for better field methods takes place. Seismology is one of the faster growing and more interesting branches of the oil industry and its practicability has been thoroughly proven.

NEWS OF THE COLLEGE

Cadettes At Cornell

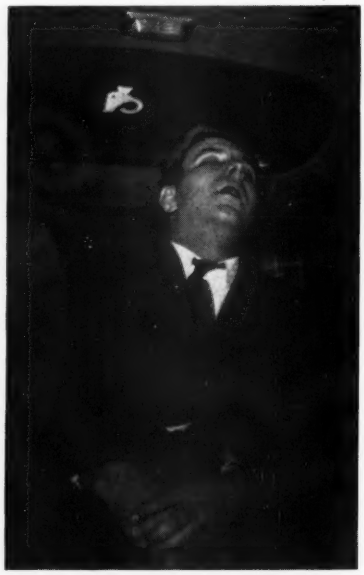
CORNELL University has been selected as one of the eight centers for training college women by the Curtiss-Wright Corporation. These women, dubbed cadettes, will be assigned to important subprofessional positions in the company's many engineering departments. The plan for Cornell has been formulated by Curtiss-Wright in cooperation with Dean S. C. Hollister and staff members of the College of Engineering of Cornell. It is designed to meet the shortage of engineering manpower in one of the largest aeronautical concerns in the country; the program calls for intensive training in technical subjects for one year, beginning February 1, 1943.

The courses of study, although dependent in the first term to some extent on the recruit's previous mathematical and scientific training, will include mathematics, elementary engineering physics, chemistry, applied mechanics, mechanical drafting, slide rule, and shop practice. The second term's work will be more specialized. It will be keyed to preparation for a specific type of work and may include such subjects as production engineering, design, electrical currents and systems, aerodynamics, stress analysis, and others of a similar nature.

One hundred cadettes will be sent to Cornell in February. These will be recruited from various colleges and universities. They will be in the employ of Curtiss-Wright, and as such they will be paid $10 a week plus room, board, and tuition by the Corporation. They will be fed and housed by the University, and be enrolled as special students, receiving all the benefits available to regular students. Thirty hours a week will be spent in class, and at least ten additional hours should be devoted to outside preparation under supervision.

Upon completing the course, graduates will be assigned to a plant and to a qualified engineering job at a starting salary between $130 and $150 per month for a forty hour week, depending on the type of work. It was pointed out that, due to the size of the Corporation, a wide diversity of positions was assured.

It was also announced that another important concern in the aircraft industry, Pratt and Whitney of Hartford, Conn., is also interested in hiring college women for technical work. A plan is in the process of being developed for qualifying women for such positions.



Professor W. A. Johnson catches up on his sleep.

Navy Opens Steam School

CAPTAIN B. W. Chippendale, U.S.N., who commands the Naval Training School here at Cornell, has formally announced the opening of a new course in steam engineering for the United States Naval Reserve Officers. Nine student officers are taking the new course at the present time; 20 more will be transferred to the course on February 1; and thereafter approximately 25 will be added each month, keeping the total at approximately 75.

Lieutenant Commander N. R. Sparks, U.S.N.R., is in charge of the course for the Navy.

Students Participate In Night Motor Convoy

IT WAS cold, d - - n cold. The mercury was close to the zero mark. Snow was falling, and the frigid wind did its best to keep the weather typically Ithaca-like. It was on two such December nights that Captain R. S. Cowen, F.A., led the ROTC Motors course, consisting chiefly of sophomores, on night marches without lights. All motors students were required to attend one march, but had their choice of nights.

Each affair started off by having fourteen men picked from the ranks of the non-drivers as route markers. These were piled into the first truck, which left well ahead of the convoy, and were deposited throughout the countryside. Their duties were to direct the convoy along the right road, to stop all traffic as the convoy passed, and in the "blacked-out" zone (where the convoy passed without lights) they were to instruct the drivers to put out their lights. Until the last truck came along to pick them up, they froze. The convoy consisted of fourteen army vehicles, including many "four - by - fours" (four wheel drives). These were driven by the students themselves. The drivers may have considered themselves lucky to have a nice comfortable seat in the cab. Once they got off the main highway, however, and the signal to douse the lights was given, the windshields were raised to obtain better visibility, conveniently letting the wind and snow into the driver's compartment. At the middle of the journey, the entire contingent stopped at a bonfire to roast marshmallows and wieners. Drivers were changed, and the trucks proceeded home.

This night march was one of the features of the wartime Motors course designed to give practical experience which can not be obtained from texts or lectures. Previously, the ROTC had taken the trucks on an afternoon march over all types of terrain in the middle of nowhere.

College Opens Map Making Course To Co-eds

DETAILS for a new course in cartography, or map making, were presented recently by Dean S. C. Hollister of the College of Engineering before a convocation of all women students in the University. In line with the University's policy of cooperation with the military, this program will provide for the training of badly needed personnel in this field for the Army.

A 60-hour course is planned, 20 of which will be lecture and the remainding 40 laboratory hours. Instruction at Cornell will be under the Engineering, Science, and War Management Training program of the U. S. Office of Education and the College of Engineering, in cooperation with the Army Map Service.

After completing the course, women may qualify under Federal Civil Service as engineering aides at $1800 a year, with opportunities to advance to $2600. Preparatory studies will deal with the making of aeronautical, planimetric, and topographic maps, map reproduction methods, photo mapping, map drafting, draftsmanship, and other similar jobs.

Eligibility for the course requires that candidates be college graduates or seniors who will have their A.B. degrees by June, 1943. Courses in science, particularly geography and geology, are helpful but not required, the same being true of experience in ink-line drawing or drafting and ability to read a foreign language.

The Army Map Service pointed out that the armed forces need hundreds of thousands of different maps. Without these, bombing missions cannot be effectively planned and executed, and ground forces cannot know the "lay of the land" in strange parts of the world. In this global war, too, many places have never been adequately mapped, and old maps must be brought up to date.

Work Nears Completion On Model Wind Tunnel

A PROJECT new on the Engineering campus which will undoubtedly arouse interest in aeronautical circles, is steadily nearing completion. On the second floor of the West Mechanical Laboratory three seniors are quietly at work on a small scale wind tunnel. Designed originally by Lt. Lynn Bussy, ME '43, now at Wright Field, the plans are being carefully followed out with slight modifications by a group of advanced undergraduate students headed by Dick Stewart, ME '43.

With an eight foot propellor driven by a 40 horse-power electric motor they hope to attain actual wind velocities of approximately 120 miles per hour. Two of the principal sections of the tunnel, the air inlet and throat, are made of wood. The construction problems involved in obtaining the necessary aerodynamic curvatures is being easily solved by the use of a laminar ring assembly. Built up entirely of thin circular slabs in this manner, the tunnel is being quickly and accurately shaped into the desired form. The final section at the exit cone is constructed entirely of beaver board, this section not being of great importance.

The tunnel has a total length of about 19 feet, a minimum diameter of 30 inches at the throat, and a maximum diameter of nine feet at the exit—where the propeller is located. It is believed that reasonably accurate results may be obtained with large scale models.

At the present time all work has been completed except the exit cone and the propeller installation. Weighing scales and calibration equipment are ready but have yet to be installed in the tunnel. With still plenty of work to be done in the final stages of assembly, the group is seeking the aid of prospective aeronautical majors who can carry on the remaining four months work to successful completion.

Sections of the new model wind tunnel being assembled in the West Mechanical Laboratory.

New Roof For Morse Hall

REGULAR visitors of Morse Hall may well rejoice soon when final arrangements for the completion of roofing the building have been settled. Already a good bit of the job has been accomplished, but there are still weak spots within easy access of roosting pigeons.

Originally built in 1890 for the chemistry department and subsequently improved through generous gifts from trustees and Andrew Carnegie in 1898 and 1911, the building was ravaged by fire in 1916. Its stately proportion distorted by the absence of the third floor and its equipment badly mauled, the trustees decided to dismantle it immediately. But somehow it survived, growing a new top piece in the course of a few months.

Quick to claim additional quarters for its expanding personnel, the College of Architecture was first to seize all possible warm and dry

(*Continued on page* 30)

"Walt"

E. Walton Ross, ME

IT WAS no last minute decision that brought Walt to the School of Mechanical Engineering at Cornell. His father is an engineer, and his brother, Bob, graduated from Cornell in 1941 with an A.E. degree. In Walt's own words, "I just took Cornell for granted."

Walt was born in Newburgh, N. Y., almost twenty-two years ago. During his early years, he lived in several towns, but finally settled down in Rochester in 1927. It was there that he received his preparatory training and there that he has spent most of his summers.

The name of "Ross" is no new one to the ENGINEER. Bob was editor-in-chief of the magazine only two years ago, and Walt now fills that same position. Since there are three more younger brothers in the family, we may well find in a few years, another "Editor Ross."

During his "frosh" year, Walt, in addition to maintaining a high scholastic average, went out for Track, and later became a member of Alpha Tau Omega. He was also elected to membership in Alpha Phi Omega, National Honorary Service Fraternity.

He began his second year by going out for the ENGINEER, and was soon elected to the Junior Board. He did such commendable work on the Board, that he was elected Editor-in-Chief of the magazine in April of the following year. During this same year, he became secretary of his fraternity and also joined the A.S.M.E.

Early this fall, Walt accepted the position of temporary House Manager at his fraternity. Later this year, he attended the annual national convention of the Engineering College Magazines Associated, as one of the two delegates sent by the ENGINEER. The convention was held on the campus of Purdue University and Walt has said that his stay there was one of the high spots of his college career.

Walt has spent his summers to good advantage. One summer was spent here at Cornell, taking a short shop course, in addition to the regular Summer School courses. During the remaining five weeks of the summer, he worked for the General Railway Signal Company on a labor gang.

He spent the next summer with the same company. This time, however, he was in charge of Special

(*Continued on page* 30)

Charles H. Barnett, AE

CHUCK Barnett seems to have been slated for engineering. He has always been interested in machines and engines, and as far back as the fifth grade in his native Cleveland, Ohio, he was drawing circuit diagrams behind his geography book. When the time came for him to choose a college, Cornell especially appealed to him, first because of the excellent AEME course offered here, and second because he had always heard of Cornell as an eastern school with a western atmosphere. He did come to Cornell and he definitely hasn't been disappointed in his choice.

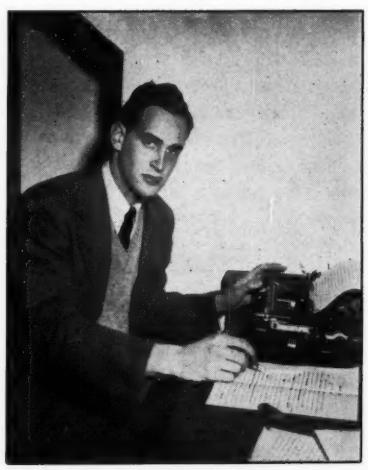
In his sophomore year, he became a compet for the CORNELL ENGINEER and was elected to the editorial board. He has written many articles for publication but isn't the first Barnett to write for a Cornell engineering publication. His father, who is a chemical engineer, contributed to the Sibley Journal to which the CORNELL ENGINEER is the successor. Another of Chuck's duties on the board has been the supervision of the photographic work, a task for which he was well prepared by his interest in photography as a hobby, and by his job as part time photographer for the Cleveland Press.

Perhaps Chuck's chief interest outside his school work has been the boys' camp in northern Ontario where, up to this year, he spent the previous six summers. During his last four years at camp he was assistant counselor of dramatics in charge of staging productions. The year before coming to Cornell he designed a theater and recreation hall for the camp, and even went up early in the summer to help build it. Since then he has designed and built a flexible control switch board and permanent scenery for the stage. Among his other interests are sailing, bowling, and swimming. He is a member of Zeta Beta Tau fraternity, and wants it known, now and forever, that he isn't related to Charlie Barnett, the band leader.

Chuck now holds the rank of cadet captain in the Advanced R.O.T.C., but expects to be called by the Army at the end of the present term and sent to Fort Sill, Oklahoma, for training, and eventually, assignment to active duty.

Before the war, Chuck hoped to get into some type of production control work. However, he now feels that it is a little early to make any definite plans for the future.

"Chuck"



NEER BOARDS . . . .

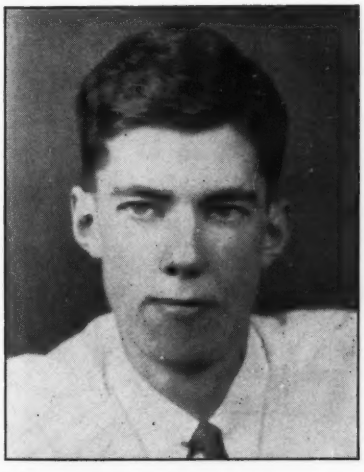
Thomas T. Harrow, CE

GRADUATION will complete a very extensive education on the part of Tom Harrow, treasurer of THE CORNELL ENGINEER. Although Tom was born in New York City, July 14, 1920, he has spent most of his younger years on the Continent. When he was six years old, his family moved to Sweden. Tom lived for two years in Sweden before moving again, this time to Switzerland. In Switzerland, he lived along Lake Geneva and went to a French school. It was here that he acquired his love for fishing, a hobby that he has pursued ever since that time.

After three years of schooling in Switzerland, his parents decided that he should broaden his education still further so they sent him to a boarding school in Germany for three years. Tom still remembers vividly his difficulty in picking up the German language. By this time Tom was of high school age so his family returned to this country and he went to Leelanau School for Boys in Michigan. Here he distinguished himself by becoming editor of the school paper. While in high school Tom busied himself during the summers by building concrete foundations and cottages. It was from this experience that he decided to become a civil engineer.

Coming to Cornell was one of those lucky accidents for Tom.

"Tom"



While visiting various colleges in the East, his father just happened to take him through Ithaca, so he stopped at Cornell and had the opportunity to talk personally with President Day. He was so impressed with this opportunity and his desire for civil engineering that he decided right away that he wanted to go to Cornell.

Tom's existence at Cornell has been just as eventful. He started his freshmen year by becoming cox for the freshmen crew. He still cherishes the summer after his freshmen year because he was a fishing counselor at a boys' camp. This was a living paradise for him because he could go fishing all day long. In his sophomore year Tom pledged Theta Chi, joined the A.S.C.E., and entered the "Engineer" Business Competition which quickly brought him a place on the Business Board. The following summer he went to Surveying Camp, and it was there that he met Maxine Rhynehart, who is now Mrs. Harrow.

Tom returned from Surveying Camp to be elected to Rod and Bob, honorary Civil Engineering fraternity, at the beginning of his Junior year. The same year he was elected Secretary of this organization, and also Treasurer of THE CORNELL ENGINEER. Tom married last May after completing his Junior year and took an apartment downtown to be with his wife.

In this present school year Tom was elected Secretary-Treasurer of the Senior C. E. Class. He was also elected Secretary of the Honor Committee, a C.E. organization

(*Continued on page* 30)

Morris Bradt, AE

WHEN the Army sweeps the graduating class into its folds in January it will be fortunate in calling "Bud" Bradt, Cadet Captain in the Ordnance Department. Bud expects to be sent to the Aberdeen Proving Grounds in Maryland. When he was offered opportunity to continue ROTC at the end of his sophomore year, Bud jumped at the

"Bud"

chance to enter Ordnance, the Army's closest approach to his chosen profession, Administrative Engineering in Mechanical Engineering. By applying himself to his work, he earned himself the grade of Captain, and was elected to the Officers' Club. He likes the Army so well that his present plans are to stay in the Ordnance Department even after the war.

Bud's talents have always been two-fold, administrative and engineering, so he took the obvious compromise when he registered for AEME at Cornell. His father and brother, both Cornell alumni, persuaded him convincingly to take this course at Cornell. So, without any doubts in his mind, Bud came to Ithaca.

Bud has made good use of his summer months. For his first two summers he worked as a laborer for the Burke Electric Company and toured the Canadian Rockies. This last summer he took the accelerated course enabling his to graduate in January before entering the Army.

In every activity he has entered, Bud has worked his way up to the top. In his sophomore year he entered the competition for THE CORNELL ENGINEER and is now Advertising Manager. He is a member of Kappa Tau Chi and serves on the Freshmen Advisory Committee. He is also Pledge Master and House Manager of his fraternity, Zeta Beta Tau. Despite these varied activities Bud has been able to stay in the upper tenth of his class with an average of 81 per cent.

A CORNELL ENGINE

Motor Co

These pictures, taken by the staff pho
depict the highlights of a con oy on the roa
three phases in order to enab e all of the stu
second phases were driven on ordinary sec
the end of the second phase, chains were p
the road condtions of the third phase were
a corduroy trail with plenty of ruts, d tch
splattering of mud, the convoy came through
worse for the experience.

Upper left: Last minute orders before leaving Barton Hall, base of operations.

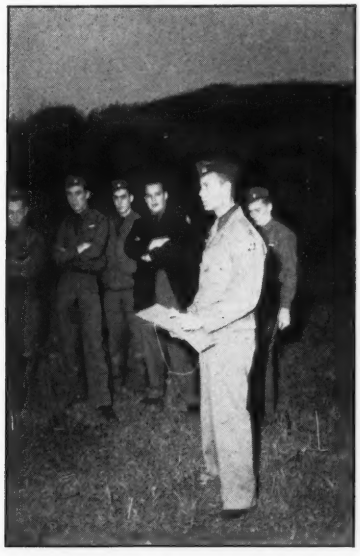
Lower left: Route markers pointing out the way.

Lower right: Convoy stopping at the end of the first phase.

Center right: Routine checkup between phases.

...ter Convoy

... by the staff photographer on an actual trip, ... con...oy on the ro...d. The trip was divided into ...nab...e all of the s...udents to drive. The first and ...en ...n ordinary second class asphalt roads. At ...ase, chains were put on to facilitate driving, for ... third phase were very difficult, the road being ...nty of ruts, d...tc...es, and hills. Aside from a ...nvoy came through with flying colors, none the



Upper right: Drivers and route markers receiving instructions.

Center left: Captain R. A. Cowen, FA, officer in charge, reviewing safety precautions.

Lower left: Putting chains on for the rough trail to come.

Lower right: Welcome refreshment after the long trek.

CORNELL SOCIETY of ENGINEERS

107 EAST 48TH STREET NEW YORK, N. Y.

GEORGE N. BROWN, *President*
55 Liberty St., New York, N. Y.

JAMES LYNAH, *Executive Vice-President*
Brunswick, Ga.

PAUL O. REYNEAU, *Secretary-Treasurer and Placement Director*
107 East 48th St., New York, N. Y.

DAVID HARMON, *Recording Secretary*
380 Pearl St., Brooklyn, N. Y.

FURMAN SOUTH, JR., *Vice-President*
1140 Wightman St., Pittsburgh, Pa.

CARLYLE M. ASHLEY, *Vice-President*
207 Brattle Road, Syracuse, N. Y.

EZRA H. DAY, *Vice-President*
1081 Broad St. Sta. Bldg., Philadelphia, Pa.

WILLIAM H. HILL, *Vice-President*
501 Klag Ave., Trenton, N. J.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

Fellow Cornellians:

Recently the Cornell Alumni Association held its biennial business meeting in New York City and your Society not only cooperated with the officers of the Association to make his meeting a success but also took part in the program.

Walker L. Cisler '22 is the Society's representative on the board of directors of the Alumni Association and has shown a keen interest in its affairs. His pressing duties with the War Production Board in Washington prevented him from attending the first session, but he was present at the dinner and the board meeting on the following day.

A general open forum meeting was held at which time reports were presented which gave a complete account of the present activities of the Association and its constituent organizations.

Among the reports made were those of the Alumni Association treasurer, Archie C. Burnett '90; of Acting Alumni Secretary, Walter C. Heasley, Jr. '30; committee on relations with secondary schools by Ray S. Ashbury '25; Alumni Regional Scholarships Committee by Edward K. Graham, Ph.D. '38; Alumni News committee by Phillips Wyman '16; Alumni Fund Council by Walter C. Heasley, Jr. '30; Federation of Cornell Women's Clubs by Mrs. Allan H. Mogenson (Adele Dean) '23, president; class secretaries by Herbert R. Johnston '17, president; Agriculture Alumni Association by Professor A. Wright Gibson '17, secretary; Architecture Alumni Association by George B. Cummings '12, president; Cornell Society of Engineers by George N. Brown '08, president; Home Economics Alumnae Association by Mrs. Whiton Powell (Jeannette Gardiner) '26, president; Cornell Society of Hotelmen by Edgar A. Whiting '29 and Veterinary Alumni Association by Professor Denny H. Udall '01, president. All these reports are bound into a booklet which may be obtained by all interested Cornellians upon request to the Alumni Office, 3 East Avenue, Ithaca or to P. O. Reyneau, Secretary of the Society.

In view of the fact that the financial setup of the Alumni Placement Bureaus has been changed and there is a possibility that their effectiveness may be impaired, your president presented a motion before this meeting asking that immediate and adequate action be taken to insure the continuance of the Alumni Placement Bureaus. This was seconded by Sidney Edlund '13 who made a very strong plea for this most useful activity and further endorsed by Charles H. Blair '98. The motion was carried unanimously and after the new president, Lawrence E. Gubb '16, chairman of the board of Philco Corp., Philadelphia, Pa. was elected he assured the Society that a committee would be appointed at once to investigate the Placement Bureaus and if convinced of their usefulness, to recommend ways and means of properly supporting them.

Mr. Gubb succeeds Creed W. Fulton '09, who has been president for the last four years.

At the convention dinner, President Day spoke on the effect of the war on Cornell.

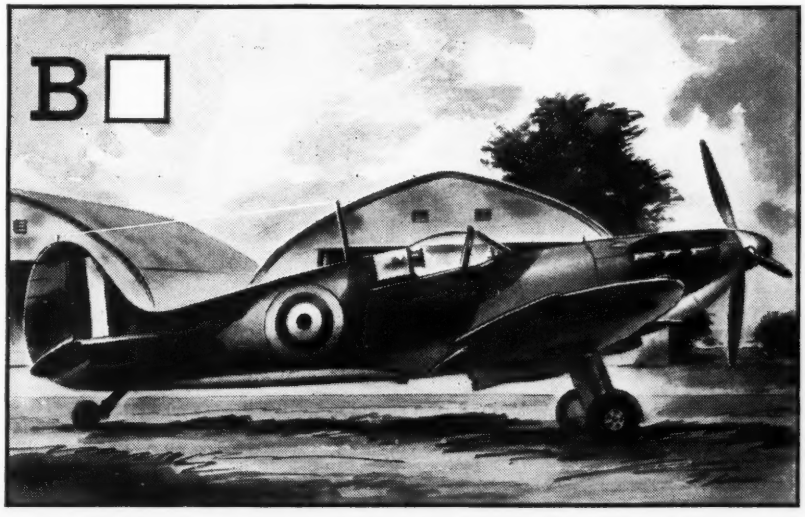
As chairman of a committee appointed by the American Council of Education, and as president of the Association of Land Grant Colleges, he has planned with the War and Navy Departments and War Manpower Commission for the effective utilization of colleges and universities in the war effort. "Not more than one-third of the colleges and universities in the country, including junior colleges and teachers' colleges, are likely to be utilized in the training program," he said. "The larger institutions, especially those with strong technical departments, will continue to be used in this work to a greater degree than at present, whereas the small colleges not having such departments will probably close for the duration," said President Day. In his opinion there will not be an able bodied man of draft age at Cornell next Spring who is not in uniform.

Even though the government is paying for each enlisted man assigned to Cornell the income is not sufficient to meet expenses and Dr. Day expects very difficult times ahead.

Every effort is being made to reduce operating expenses in order to keep in step with reduced income; but during this transition period to an all out war effort, this is a most difficult thing to do.

"College students," he said, "are ready to serve; they are not holding back, but want to be told where they can best be used. Their spirit of complete devotion—complete sacrifice—must permeate us all if we are to win this war. We can not take it in our stride, but must all step up our stride."

Sincerely yours,
GEORGE N. BROWN
President



WHICH would you vote "most likely to succeed?"

"The Aircraft Warning System gives a single plane on ground alert the equivalent striking power of 16 planes on air patrol." This startling statement comes from England.

Our country's Aircraft Warning Service — quite similar to England's—keeps a constant check on the flight of all aircraft. Should the need arise, it is prepared to send fighter planes aloft, to mobilize and direct ground defense forces, to warn endangered areas. Every step in its operation requires the fast, accurate communication of the telephone.

This is just one of the many wartime jobs that are keeping telephone lines busier than ever before. To help us keep lines clear for vital military and industrial calls, please avoid using Long Distance to war activity centers unless the call is urgent. And please keep all your telephone calls as brief as you can. Thank you.

WAR CALLS COME FIRST!

BELL SYSTEM

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES

THE ALUMNI

Cornellians Win Awards For Industrial Progress

TEN Cornellians have won awards in the $200,000 industrial progress program of the James F. Lincoln Arc Welding Foundation of Cleveland, Ohio. Engineers, designers, architects, maintenance men, and industrial executives submitted reports of arc-welding processes which they had perfected during the period from January, 1940 to June, 1942.

Asham P. Amirikian, C.E. '25, designing engineer in the Bureau of Yards and Docks, Navy Department, Washington, D. C., shared the first award of $13,700 with his chief, Capt. C. A. Trexel, USN, Director of Planning and Design. Amirikian submitted a method of arc-welding caissons for Naval Drydocks which will save one-third the construction time, 9,000 tons of steel, and $3,540,000 in cost.

The first award of $700 in the division of petroleum industry machinery went to Egon F. Brummerstedt, C.E. '35, now mechanical engineer in the petroleum refining division of the Foster Wheeler Corporation. Thomas R. Rollo, C.E. '10, consulting engineer of Mendota, Wisconsin, won a $150 award in the structural bridges division. Harold C. Whitehouse, Arch. '15, took honors in the division of house furniture and fixtures.

The following men each received $100 awards: in the division of processing machinery, William J. Miskella, E.E. '05, chief engineer, Infra-Red Engineers and Designers; in the division of maintenance of structures, Felix S. Hales, C.E. '16, bridge engineer of the New York, Chicago and St. Louis Railroad; in the division of containers, contents moving (pipe lines), Charles H. Capen, Jr., C.E. '17, chief engineer of the New Jersey Water Supply Commission; in the division of containers, contents stationary (tanks), Robert C. Kennedy, C.E. '21, assistant chief engineer and assistant general manager of the East Bay Municipal Utility District, Oakland, California; in the division of machinery maintenance, Carlman M. Rinck, M.E. '24, chief engineer of the Trenton Potteries Corporation; and John D. Russell, E.E. '29, electrical engineer of the Joy Manufacturing Co. shared the $100 award in the division of industrial machinery.

Frank S. Senior, C.E. '96 Dies

FRANK Sears Senior, C.E. '96, known especially for his railroad construction and pneumatic foundations, died in Montclair, New Jersey on November 29th at the age of 66. After receiving his degree from Cornell, he was with the Arthur McMullan Company from 1899 to 1929, from 1909 on as vice-president. In 1929 he formed Senior and Palmer, Inc., construction contractors, now at 50 Church Street, New York.

One or the other of these firms built, under his direction, foundations for the bridges spanning the Susquehanna River at Havre de Grace, Maryland; the Missouri at Pierre, S. D.; the Ohio at Steubenville, Ohio; the Monongahela at Pittsburgh; the Delaware at Trenton, N. J.; the Hudson at Castleton, N. Y.; and the Housatonic at Milford, Connecticut.

In the last war Mr. Senior served in France for eighteen months as a major, Transportation Corps, A.E.F., and was cited for "meritorious and conspicuous service."

Mr. Senior belonged to the Cornell University Club of New York, the American Society of Civil Engineers, and the Psi Upsilon fraternity.

Tell Berna Speaks Before Senior Engineers

TELL Berna, M.E. '12, gave an enlightening talk on "Industrial Problems in the War Effort" before Cornell's senior engineers. Mr. Berna is General Manager of the National Machine Tool Builders Association.

Mr. Berna described business as "a constant state of flux and change." "We must adopt ourselves", he said, "to constantly changing conditions." He spoke principally of the machine tool industry and its tremendous responsibility towards the whole war effort.

"Forty per cent of the machine tool industry was automotive before the war. The average shop employed around 180 men and all together they produced some 220 different kinds of machine tools of varying sizes and shapes. As a single illustration of changed conditions brought on by the war, there were 2360 companies making thread grinders before the war to our 4 companies making them today.

"England is far ahead of the United States in obtaining work per man hour. What we need is a few bombs exploding in our back yards to make us realize that we are fighting a war. Our plants could step up production by 30% tomorrow morning if we had the incentive to do it."

In concluding his talk, Mr. Berna asked the class to challenge his statements because if they believed everything he told them, then they wouldn't be piloting their own boats.

A. W. Brunot, M.E. '34 Writes Article In G.E. Paper

A. W. BRUNOT, M.E. '34, has just written an article entitled "Thermocouples" for the November issue of the General Electric Review. Mr. Brunot works in the Thomson Laboratory of the General Electric Company.

The article, written in collaboration with H. B. Lancaster, described the calibration of thermocouples at fixed points with tin, lead, and aluminum freezing-point furnaces modeled after those of the Bureau of Standards. It also described the use of sulfur furnaces for immersions from four to twelve inches over which range the temperature variation was approximately .06°F. These thermocouples were developed because of the need for proper calibrating facilities.

Companies Receive Army-Navy Awards

AMONG the many industrial firms headed by Cornellians which are breaking all production records to help the Country's war effort, the latest to receive the Army-Navy "E" award is the Buffalo Forge Company, of which Edgar F. Wendt, M.E. '11, is president. Buffalo Forge ventilating and heating equipment is used on many ships of the Navy and Merchant Marine and in industrial war plants of all kinds. Last September, the "E" banner was presented to Buffalo Pumps, Inc., a subsidiary of Buffalo Forge. Forty-eight of the vital pumps and the entire hull ventilation with 187 fans of the new 45,000 ton battleship U.S.S. New Jersey were supplied by these firms.

The first industry in the Rochester area to receive the Army-Navy "E" was the Gleason Works, of which James E. Gleason M.E. '92, is president. Gleason bevel gear cutting machinery makes gears that are used in guns, ships, tanks, trucks, airplanes, and many other kinds of fighting equipment.

Among the many other firms in which Cornellians are active, awards have been made to the Omaha Steel Works, Omaha, Nebraska, of which John W. Towle, C.E. '94, is president, and to the American Pulley Company, Philadelphia, Pa., where Creed W. Fulton, M.E. '09, is assistant to the president.

The earlier Navy "E" was awarded to the Northern Pump Co., Minneapolis, Minn., of which John B. Hawley, Jr., C.E. '21, is president and general manager; the Carrier Corp., Syracuse, N. Y., of which Willis H. Carrier, M.E. '01, is chairman; the E. I. duPont deNemours & Co., Wilmington, Delaware, of which Walter S. Carpenter, Jr., M.E. '10, is president; the Ford Instrument Co., Long Island City, of which Hannibal C. Ford, M.E. in E.E. '03, is president; the Manitowoc (Wisconsin) Shipbuilding Co., headed by Charles C. West, M.E. '00, and in which his sons, John D. West, M.E. '32, and Robert D. West, M.E. '34, are executives; the Camden Forge Company, Camden, N. J., where Ward D. Kerlin, M.E. '01, and Samuel P. Howe, M.E. '02, are officers; several plants of the Phelps-Dodge Copper Products Corp. of which Wylie Brown, M.E. '98, is president; and several plants of the Sperry Gyroscope Company in which Edward G. Sperry, M.E. '15, is an officer.

Dr. Burt, E.E. '21 Invents New Welding Lens

DR. ROBERT C. BURT, E.E. '21 in collaboration with Corning Glass Works technicians has invented a new welding lens through which the welder sees only the "working puddle" of molten aluminum. The lens eliminates the brilliant glare from the hot hydrogen welding torch which blinded the worker and obliged him to work entirely by experience without actually seeing the operation. With the aid of the lens, work is speeded up, efficiency increased, and eyestrain greatly reduced.

Employed in the Plant Engineering Department of the Lockheed Aircraft Corporation of Burbank, California, Dr. Burt has twenty other patented inventions to his credit. While at Cornell, he spent three years on the board of the *Sibley Journal of Engineering* (now the CORNELL ENGINEER) and was a member of the Cornell Masonic Club, Lambda Chi Alpha, and the College Honor Group.

H. Blair Hull, M.E. '13

NEWS has been recently received of the death of a prominent Cornell engineer at Dayton, Ohio. He was H. Blair Hull, 51, widely-known inventor and research engineer of the Frigidaire division of General Motors Corp.

Mr. Hull worked with three other scientists in the development of the fever machine, and perfected the cooling device for that machine. He also worked on the iron lung and Pavex machine, a vaccular exerciser used to counteract arterial deficiency in circulation. Blood bank research also engrossed him.

In 1939 he received the Modern Pioneer award for distinguished service in the field of science. He wrote a book, "Household Refrigeration," used extensively as a college textbook. More than 100 patents have been credited to his engineering genius.

Mr. Hull received the degree of mechanical engineering from Cornell in 1913. He served a year and a half overseas as a captain in the first World War.

Charles J. Goldmark, G. '89

CHARLES J. Goldmark, a retired electrical and consulting engineer from White Plains, New York, who received a degree in 1889 from the graduate engineering school at Cornell, died on November 4 at 75 years of age. Mr. Goldmark, who once kept offices in New York City, specialized in the design of electrical equipment for industrial plants and in the design and construction of railroad shops in this country and in Canada.

Mr. Goldmark was born in Brooklyn, and attended Yale University, from which he was graduated in 1887, and Cornell, from which he was graduated two years later.

Everett Drennen, C.E. '08

EVERETT Drennen, C.E. '08, at present a civil engineer in Wheeling, W. Va., and vice-president of Rivercoal, Inc., is in charge of the novel venture of mining coal from the Ohio River. There was no precedent in choosing equipment, materials, or men because coal had never been mined from a riverbed before. After a year of preparation, daily production averages 700 tons which Drennen and his fellow-officials say is just a start.

Use The Cornell University Placement Bureau

WILLARD STRAIGHT HALL — H. H. WILLIAMS, '25 Director

"Loose Juice"

By BOB GARMEZY and ED RICH

Daffynitions

Ohm: the sweetest word in the English language.

Large Current: a large specimen of a small seedless raisin produced chiefly in the Levant.

Power Dissipation: giving out energy to no good purpose.

Genius: one who passes a 421 prelim.

CE: a glorified architect with football training.

ME: an oil covered arts student.

Chem E: an engineer who doesn't realize the significance of $KNO_3 + sex = KO_2 + NO\ sex$.

EE: an engineer who goes straight to Willard instead of to Willard Straight.

Yehudi: the owner of a new rubber tire.

Fuel: what a person who writes humor is.

Vacation: blondes and gin fizzes.

Heaven: to live as long as Methuselah and have Solomon's wives.

Blotter: what you look for and can't find until what you want it for isn't.

* * *

A Poetic Presentation of Our Accumulated Knowledge Concerning a Subject Far Removed from Common Personal Practice Through No Fault of Our Own, Due to the Fact That There Are Only Twenty-Four Hours in a Day,

or

Sleep — Wherefore Art Thou!

Read by an E.E. to his Public Speaking Class

Last night after midnight dreary,
As I pondered with eyes bleary,
Attempting to produce a thought
which I could speak of from
the floor,
Suddenly there came a churning,
As of brain-wheels slowly turning,
Grinding out the subject: "We
should take more time to
snore."
Sleep, combined with dreams
galore!

Thus, with topic finally chosen,
I abruptly ceased my dozin'
And began to arm myself for the
ordeal which was in store.
As I struggled, barely wakened
From the sleep I had forsaken,
I began to realize that I should
have done this stuff before.
Yes, I mean long before!

So you see the value plainly
Of attacking this more sanely,
At an hour more conducive to completion of this chore.
Henceforth, plan your work with
foresight
So you'll be in bed by midnight,
And the worries won't beset you
which have bothered you before.
Oh so many times before!

This page is written by and for EE's. Any suggestions, criticisms, or humorous contributions will be welcomed. Please drop all such material in Prof. Cotner's box on the first floor of Franklin Institute. In this issue we share the blame with Bud Thompson, Milt Stolaroff, Bob Sailor, Frank Witmer, Bob Seldon, and Professors Ballard, Strong and Credle.

Warning to Women

Verily I say unto you, marry not an engineer.
For an engineer is passing strange, and possessed of many evils.
Yea for he picks his seat in the car by the springs and not by the girl beside him.
Neither does he know a waterfall except by its power,
Nor a girl except for her specific heat.
Yea, though he holds his girl's hand, it is only to calculate the friction thereof.
And he kisseth only to test the viscosity.
He fondleth the hair to measure the elasticity, and inscribeth his passion in formulae.
And his marriage he deemeth a simultaneous equation involving two unknowns and yielding divers products and problems.

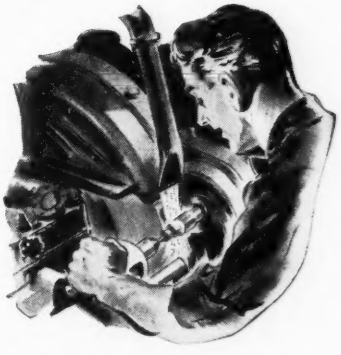
* * *

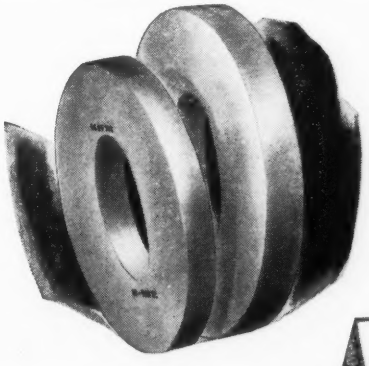
It is alleged that Burkmyer, Credle, and Smith have reached an all time low in their checking accounts. Is this *report* true?

Now they fly ten times as long without overhauling!

The flimsy crates of World War 1 needed overhauling after as little as 24 flying hours. But today's planes fly hundreds of hours at much higher speeds before a major overhaul. The reason? New materials, new designs and new methods of finishing metal surfaces. Finishes so nearly perfect that bearings, cylinders, pistons and cams are made practically wear-proof! It's a process in which Carborundum has played an important part...by supplying the finishing wheels and stones required.

Formerly ultra-finishing was a long tedious task. But thanks to the new process, finishes accurate to a few millionths of an inch can now be produced on ground surfaces on a production basis. Application of these finishes to wartime engine production has improved the fighting efficiency not only of planes, but of tanks and other motorized equipment. Fewer men are needed for maintenance and repair.





Ultra-finishing—is only one of many ways in which Carborundum may be able to help save precious time. When you get out in the field and encounter a production problem that abrasives might solve, write The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
Reg. U.S. PAT. OFF.
ABRASIVE PRODUCTS

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The Engineer Comments . . . . . The Editors

NOW that we have the man power question well defined before us, we have no excuse for doing mediocre work. Our government has decided that for the present, engineering students should remain in school to further their education. We are among the selected few, so it is up to us to show that we are worthy of this consideration.

Many engineering students will nevertheless be leaving school in January. They may feel that they belong in the Armed Forces rather than in school. Others may be tired of book learning and are looking forward to a release through adventure and excitement in the Army. If they believe that they have made a wise choice, i.e., to leave school to pursue other courses, we wish them God speed and success in their new undertaking. But may we caution them on one thing? During the last war, a large number of students left school to enlist in various branches of the service. We were in that war only nineteen months, yet only ten per cent of the engineering students found their way back to school after the war to finish up their work for their degree.

In this war we have all ready been fighting over a year and we are still a long ways from victory. Chances are that this war will last far longer than nineteen months, the duration of our engagement in the last World War. Therefore, our decision this January whether we should continue our education or join the Armed Forces is not easy. Assuming that we are one of the average persons in the College of Engineering, our choice to remain in school will probably mean a degree at some future date, but if we should decide to leave school this January, then we may call an end to our formal education. Think this over carefully and may you make the right decision.

* * *

A WAR is always a period of constant flux and change. THE CORNELL ENGINEER is not immune from changing conditions as the war proceeds, so we quite often find ourselves obliged to make necessary changes. We are now happy that we can make a new change on our mast head, and hope that you have already noticed it. It appears only as a slight change but we like to look to it as a significant change.

Beginning with this issue and continuing for the duration we have deleted the class distinction from our mast head. We no longer recognize individual freshmen staffs, sophomore or junior boards of our publication. In their place we have

(Continued on page 30)

Scratchboard drawing in Higgins Ink by W. Parke Johnson. Courtesy of American Telephone & Telegraph Co.

HIGGINS INKS
more power to your pen

Higgins *completes* the power circuit between your brain, eyes, hand, pen and board. An ink whose jet-black fluidity lends itself to your every mood. For clean drawings devoid of bubbles, chips or jagged edges, use Higgins.

This and other illustrations appear in Higgins new "Techniques." One copy free to art instructors writing on school stationery. All others 50 cents.

HIGGINS INK CO., INC.
271 NINTH ST., BROOKLYN, N. Y., U. S. A.

LAVA

Manufacturers of
Super-Refractories Only

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GRAPHITE CRUCIBLES
REFRACTORY CRUCIBLES
HIGH-TEMPERATURE CEMENTS
SPECIAL REFRACTORY
BRICK, TILE, SHAPES

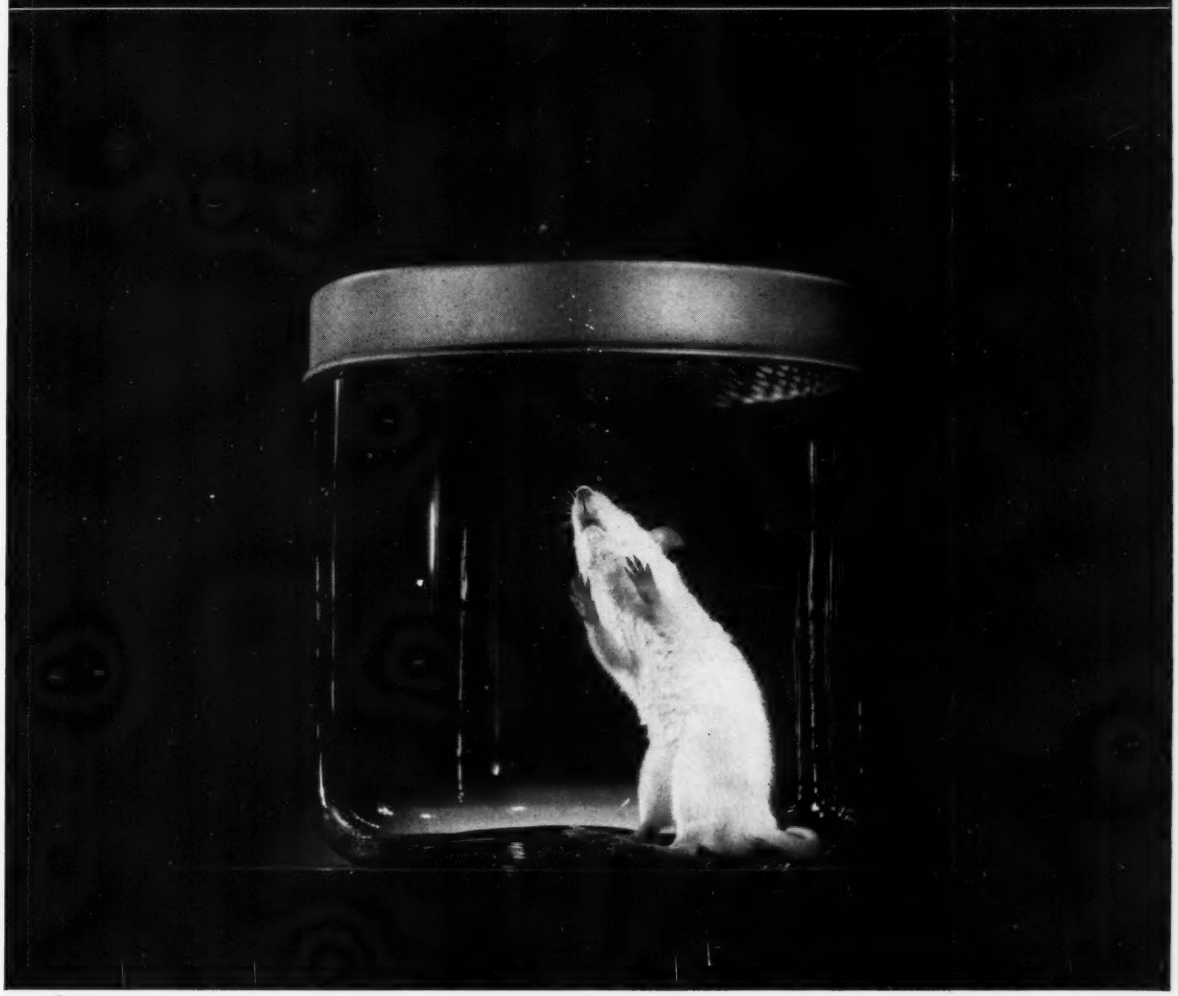
●

From the Following Materials:—
Graphite, Silicon Carbide, Fused Alumina, Mullite, Magnesia, Zircon.

●

LAVA CRUCIBLE COMPANY of PITTSBURGH
Pittsburgh

The rat that went to college...



CHARLEY, the large and healthy white rat shown above, not only goes to college but he lives in a glass house!

For Charley is one of the thousands of white rats used for scientific research in American college laboratories. His glass house is a Pyrex animal jar, for a couple of good reasons: One, because of its exceptional mechanical strength. Two, because Pyrex glass can be sterilized in live steam without breaking or becoming cloudy, which makes it a favorite with laboratory men.

Pyrex laboratory ware, developed during the last war to replace imported glass, is just one of Corning's many research contributions to better living. Others are everywhere. The glass tubes in your radio. Beacons that guide American planes. Glass pumps and piping in busy chemical and food plants. Signal lights and insulators on our warships.

Corning knows glass. Knows how to make it resistant to chemicals and heat, strong and hard to withstand impact and abrasion, accurate to tolerances ranging as low as 0.00002 of an inch.

This knowledge is being put to good use today. A special sanitary glass piping, for example, has just been developed to ease the dairy industry's shortage of metal. The communications industry, faced with a sudden wartime demand for insulators in intricate shapes and with special electrical characteristics, is using glass insulators quickly developed by Corning.

Design engineers who are licking this war's problems are finding ever new uses for glass. For tomorrow's engineers also, glass is the material with unlimited possibilities. Industrial Division, Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass

SENIOR CLASS, 1943, SIBLEY SCHOOL OF MECHANICAL ENGINEERING

Administrative Engineers

1. Good, R. V.
2. Ellis, C. D.
3. Rogers, W. B.
4. Bergrun, N. R.
5. Levy, S. W.
6. Kulka, J. M.
7. Danforth, T. H.
8. Dall, J. J.
9. Director W. N. Barnard
10. Johnson, R. V.
11. Keats, J. E.
12. Kuhn, R. P., Jr.
13. McCann, R. F., Jr.
14. Allen, H. C.
15. Glass, A.
16. Wiggin, B. C.
17. Steenburgh, R. C.
18. Kandiko, J. C., Jr.
19. Gilmartin, D. T., III
20. Bruderlin, E. B.
21. White, A. J.
22. Wheller, H. S., Jr.
23. Williams, F. B., III
24. Sands, M. D.
25. Tofias, A. B.
26. Pope, J. R.
27. Pope, B. A.
28. Colbert, C. A.
29. Whipple, C. J., Jr.
30. Ludwig, E. E.
31. Fairbank, R. J.
32. Rice, J. D.
33. South, F., III
34. Flint, C. W., Jr.
35. Helmick, L. G., Jr.
36. Fraser, W. A. R.
37. Henderson, R. F.
38. Baer, J. W.
39. Hudson, J. H.
40. Greene, V. R. H.
41. Ketcham, J. P.
42. Anderson, F. J.
43. Bradt, M., Jr.
44. Krakauer, E. G.
45. Schrader, H. W.
46. Berger, J. W., Jr.
47. Johnson, P. V.
48. Bucher, W. W., Jr.
49. Marchev, G. B.
50. Turk, T. G.
51. Slater, J. E., Jr.
52. Breathed, J. W., Jr.
53. Murphy, R. B.
54. Dickhart, W. W., III
55. Burpee, C., Jr.
56. Young, D. H.
57. Alcott, C. W.
58. Pennock, J. C.
59. Sundheim, P. J.
60. Bernard, H. F.
61. Hunt, S. J.
62. Richards, J. T.
63. Barnett, C. H.
64. Mitchell, R. J.
65. Mabbs, E. C.
66. Zayas, F.
67. Gomez, F. F.
68. Stocking, J. W.
69. Griffith, R. D.
70. Russell, J. A.
71. Rice, R. L. M.
72. Purdy, J. A.
73. Coons, D. J.
74. Clark, A. J.
75. Mallen, P., III
76. Goodyear, C. H.
77. Iliff, C. C.
78. Lamp, C. W.
79. Eddy, A. B.
80. Swanson, J. R., Jr.
81. Krehbiel, R. C., Jr.

Mechanical Engineers

1. Dedlow, R. P.
2. Sens, W. H.
3. Sipperly, H. P.
4. Hodges, J. T.
5. Underwood, R. H.
6. Swallow, G. L.
7. O'Brien, J. C.
8. Dean S. C. Hollister
9. Director W. N. Barnard
10. Warren, R. E.
11. Parker, R. S.
12. Connell, M. W.
13. McGinnis, P. R.
14. Pierpoline, M. F.
15. Brucker, W. S.
16. Dusinberre, R. G.
17. Brooker, R. C.
18. Binder, A. F.
19. Haentjens, W. D.
20. Holt, S. G.
21. Flack, R. H.
22. Luce, P. E.
23. Schneider, F. R.
24. Worn, G. A., Jr.
25. Wilson, J. T.
26. Loughridge, C. H. Jr.
27. Pressler, C. W.
28. Ryon, R. C.
29. Gill, A. S., Jr.
30. Brown, S. L.
31. Chamberlain, R. S.
32. Broglie, F. J. J.
33. Staats, G. P.
34. Junge, R. M.
35. Seeley, W. R.
36. Mearns, W. III
37. Specht, H. M.
38. McLaughlin, W. E.
39. Kay, M. L.
40. Pierce, L. J.
41. Perry, R. W., Jr.
42. Ward, D. A.
43. Miller, R. P.
44. Silver, A. H.
45. Prisch, R. A.
46. Matteson, D. H.
47. French, D. E.
48. Lockwood, G. H.
49. Hall, T. A.
50. Pace, R. B.
51. Wells, R. C.
52. Kaveny, P. J.
53. Thiebaud, M. E.
54. LaCroix, A. J.
55. Abelson, A. D.
56. Katzenstein, W., Jr.
57. Dean, W. S.
58. Pierce, W. B.
59. Eppler, J. H.
60. Chase, J. B.
61. McGlaughlin, G. W.
62. Sullivan, A. D.
63. Stewart, R. W.
64. Esperson, D. H.
65. Adee, T. C.
66. Lewis, F. H.
67. Fenger, C.
68. Sait, A. J.
69. Spransy, C. H.
70. Morewood, W. H.
71. McDougal, J. A.
72. Morse, T. K.
73. Johnson, D. W.
74. Harper, J. F.
75. King, W. B.
76. Ross, E. W.
77. Candler, W. J.
78. Egbert, P. T., Jr.
79. Quillman, B.
80. Donnally, F., Jr.

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Offers Courses of Study in the Following Fields:

Civil Engineering

1. General four-year course leading to the degree of Bachelor of Civil Engineering. Options are offered in Administrative Engineering, Sanitary Engineering, Structural Engineering, Hydraulic Engineering, Transportation Engineering, and Geodetic Engineering.
2. Six-year course leading to the degrees of Bachelor of Arts and Bachelor of Civil Engineering.
3. Four-year course in Administrative Engineering in Civil Engineering leading to the degree of Bachelor of Science in Administrative Engineering.
4. Five-year course leading to the degrees of Bachelor of Civil Engineering and Bachelor of Science in Administrative Engineering.

Mechanical Engineering

1. General four-year course leading to the degree of Bachelor of Mechanical Engineering. Options are offered in the senior year in Power-Plant Engineering, Heat Engineering, Industrial Engineering, Automotive Engineering, Aeronautical Engineering, Engineering Mechanics, Metallurgical Engineering, and Mechanical Engineering Design.
2. Five-year course leading to the degree of Bachelor of Mechanical Engineering.
3. Six-year course leading to the degrees of Bachelor of Arts and Bachelor of Mechanical Engineering.
4. Four-year course in Administrative Engineering in Mechanical Engineering, leading to the degree of Bachelor of Science in Administrative Engineering.

Electrical Engineering

1. General four-year course leading to the degree of Bachelor of Electrical Engineering.
2. Six-year course leading to the degrees of Bachelor of Arts and Bachelor of Electrical Engineering.
3. Four-year course in Administrative Engineering in Electrical Engineering leading to the degree of Bachelor of Science in Administrative Engineering.

Chemical Engineering

1. Five-year course leading to the degree of Bachelor of Chemical Engineering.

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Graduate Work

Courses leading to the Master's and Doctor's degrees are available in all the above fields.

Engineering Research

Facilities are available for conducting fundamental and industrial researches in the foregoing fields in cooperation with industries.

For Detailed Information, Address
The Dean of the College of Engineering, Cornell University
Ithaca, New York

Engineer Comments

(*Continued from page 26*)

the Editorial Board and the Business Board which you will notice from the mast head contain men of many different numerals.

None of us know definitely how long we will be able to continue our education at Cornell. While this condition prevails, we believe that all members of our publication should receive credit for their work, and not just the Juniors and Seniors who previously were the only ones appearing on our mast head.

Walt Ross

(*Continued from page 16*)

Engineering Problems. The work made him directly responsible to the chief engineer, and included a great deal of machine design plus some experimental work.

In carrying out his assignments, he was required to know a great deal about the 105mm. shell.

Walt has several other interests, chief among which is sailboat racing. He has his own boat on Keuka Lake, and the club to which he belongs has the largest fleet of identical-class sailboats in the world.

Walt plans to get into the Army soon. After it's all over, however, he hopes to obtain a job in some medium sized concern anywhere in the United States, where he can work on the design and improvement of machinery, especially the internal combustion engine.

Tom Harrow

(*Continued from page 17*)

which has set a fine example for the whole Engineering College.

He is interested in railroad work and looks hopefully to the railroad industry for his life occupation. He is always well dressed and well versed on current affairs. He likes to travel, sail, fish, and fly. His flying experience is rather limited but after the war Tom expects to take it up more seriously.

Morse Hall

(*Continued from page 15*)

spots in the building with the Department of Music running a close second. It was not long, though, before its thin paper and board covering began to yield. Since that time until recently, "drip pans" were a common sight throughout the building.

Last year these obstacles were removed and a more permanent and becoming roof was attached. Garnished for the first time in a neat dark stained border this new covering should ease and comfort fidgeting occupants, long disturbed by playful rain-drops and fluttering pigeons.

Cornell's ROTC

(*Continued from page 8*)

lems of chemical warfare in relation to the problem of supply in the field is also included in the course. The study of aerial photographs is an important phase of the work. The Quartermaster Corps Functions includes the study of the mission and operations of the Corps. Fiscal accounting and procurement discusses and considers the accounting and purchasing procedures as used in the Army today.

The young officer must have a knowledge of Company Supply, and this is covered in Unit Supply. The important problem of Salvage covering all fields is given in the second term. One of the most inter-

(*Continued on page 32*)

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"It is a job for the engineer"

Magazines and newspapers recently have published many pictures of buildings and machines that will create the new world which will arise from the ruins of war. These pictures are interesting and comparatively quickly made by artists with talent and imagination. But, to turn these imaginative pictures into realty will take time and plenty of hard work. It is a job for the engineer. The young men of America who are schooled in the science of engineering face a promising potential. They can look for guidance to organizations which before and during the war have demonstrated that our Country leads the world in applied science. Working together, we can do a grand job for America and the world.

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(*Continued from page* 30)

esting subjects studied is Quartermaster Field Operations, Part I. This course includes maps and map making, organization of the Army, and the interpretation of the tables of organizations. Military leadership includes the fundamentals of leadership and command with emphasis of the student instructing and commanding the squad, section and platoon. The practical application of instruction, the handling of men and the theory and practice of drill complete the term's work.

In the 2nd year of the Advanced Course, the student begins his study for his commission with military law. This course emphasizes the relation of the law to the Army and to the individual. Methods of instruction in military training is designed to prepare the student by study and example the fundamental principles of pedagogy and the training of men. Practical application of these principles is provided and opportunity is given the student to express himself on the drill floor and in the classroom. An Army travels on its stomach and therefore subsistence and mess management including the principles of rations, distribution, inspection, storage, preparation of food, sanitation and field messing are studied.

R.O.T.C. group operating radio at summer camp.

The movement of troops, supplies, animals, baggage and the individual is included in commercial transportation. A part of the course includes protection of military information, protection against carelessness, protection of the individual in the field, and morale and its development. A study is made of the Officers' Reserve Corps, a review of map reading, and preparation for overseas, which includes wills, allotment of pay, insurance and other pertinent data of importance to the individual preparing to depart for foreign duty.

The Quartermaster Field Operations, Part II continues in detail Part I. It includes the division, convoy operations, motor maintenance and inspection, regulating

(*Continued on page* 34)

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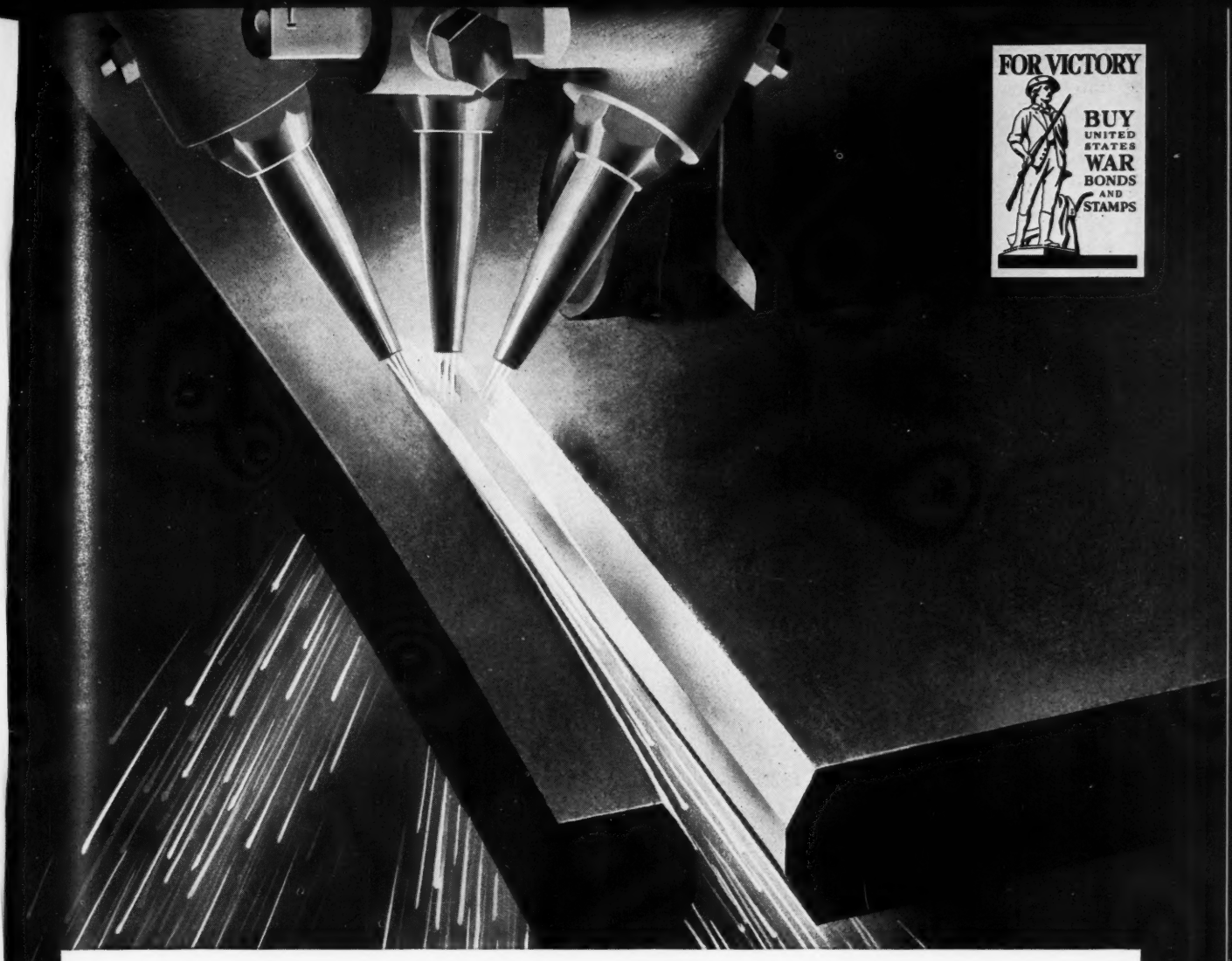
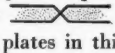
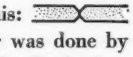


FLAMES THAT CUT TIME!

TODAY, ships are needed as never before. And today, ships are being built as never before . . . and built faster, stronger, and with less steel . . . thanks to welding!

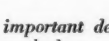
But before welding can take place, steel plates have to have their edges beveled and squared-up so that, when butted together, they look like this:  or like this: 

In the past, preparing plates in this manner was done by heavy machine tools. Cutting was slow and costly. Each plate had to be handled many times. Plate cutting on this basis could hardly keep pace with welding today.

Now, oxy-acetylene flames . . . *cutting in different planes simultaneously* . . . prepare the edges of steel plates of any commercial thickness *at one pass* . . . in a fraction of the time required by mechanical methods!

This Linde flame-planing method is as simple as ABC. It is economical . . . and easy to use. It cuts plates so smoothly and accurately that *no machining is necessary!* And it uses materials which can be produced in abundance.

On-the-job power requirements for flame-shaping are negligible . . . for the reaction of the cutting oxygen jet with the hot steel does all the work . . . and only fractional horsepower is required to move the cutting nozzles along the line of cut.

In conjunction with "Unionmelt" Welding . . . an amazing electrical welding process that unites plates of any commercial thickness faster than any similarly applicable method . . . like this  . . . the Linde method of plate-edge preparation is working miracles in speeding up shipbuilding.

These two methods are also helping to break production records in other fields. Great pressure vessels . . . locomotive boilers . . . huge pipes . . . heavy chemical tanks . . . combat tanks . . . artillery mounts . . . and other vital equipment are being turned out faster because of them.

Linde research, intensified today, is constantly solving new problems in flame-cutting, flame-fabricating, and flame-conditioning of metals for war production.

The important developments in flame-cutting—and other processes and methods used in the production, fabrication and treating of metals—which have been made by The Linde Air Products Company were facilitated by collaboration with Union Carbide and Carbon Research Laboratories, Inc., and by the metallurgical experience of Electro Metallurgical Company and Haynes Stellite Company—all Units of Union Carbide and Carbon Corporation.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Offices: New York, N. Y. **Offices in Principal Cities**

(*Continued from page* 32)

stations, rail-heads, class I supplies and their distribution, the quartermaster plan and estimate of the situation, field orders and special operations including arctic, desert and jungle warfare and the principles of landing operations.

Ordnance Unit

In today's modern warfare, utilizing new designs and developments of instruments of war, the Ordnance Department occupies an important position. It is concerned with the design and development, the manufacture or procurement, and the supply and maintenance of all arms and ammunition. Its responsibility has been extended to include all motor vehicles in addition to its other charges in the same field, that of combat vehicles and tanks.

Applied engineering from the fields of the mechanical, chemical, metallurgical, and electrical engineers enable the Ordnance Department to perform its functions to produce for example projectiles with component propellants, high explosives and intricate fuzes, artillery for field, sea-coast, railway and anti-aircraft employment, fire control instruments, bombs, and small arms and automatic weapons. Maintenance and supply problems of course follow design and production. The Ordnance Department maintains a far-flung organization to meet and solve these problems.

The Ordnance Unit at Cornell University comprises an Advanced Course only. Prerequisite to the Ordnance Advanced Course, admission to which is limited to students in the College of Engineering or the Department of Chemistry, is completion of either the Field Artillery or Signal Corps Basic Course.

The Ordnance Advanced Course offers military instruction designed to be superimposed on the technical education given the student in the College of Engineering.

To review the course of instruction, in the first year various subjects of related interest are covered: ordnance material, general, ammunition, general, aerial photograph reading, map reading, individual protective measures, the ordnance provision system and property accounting, organization of the Ordnance Department, leadership and command.

In the second year of instruction the subjects covered clarify the over-all picture of the Ordnance Department and enlarge the student's conception of the duties to be required of him as a commissioned officer in the Ordnance Department. Subjects are covered as follows: ordnance district organization and administration, ordnance supply operations in war, ordnance service and supply details, operation and functioning of motor vehicles, Officer's Reserve Corp regulations, company administration and supply, rifle and pistol markmanship, military law, leadership and command.

Credit is allowed for technical subjects of interest to Ordnance given in addition to those shown above by the College of Engineering and the Department of Chemistry.

The Ordnance Advanced Course offers in addition to war-time opportunities a supplement to the engineering courses toward the well rounded education highly beneficial to the civilian engineer.

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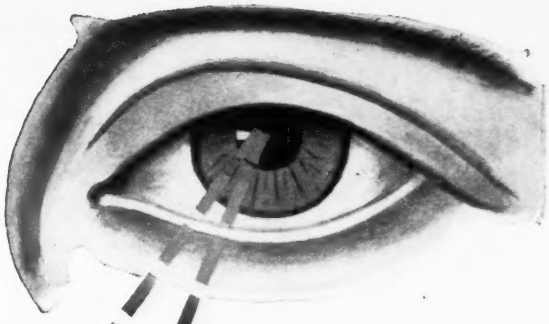

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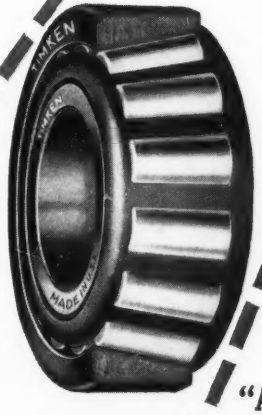

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STRESS and STRAIN...

A little boy swallowed a bullet. His mother became worried and went to the drug store to inquire what she could do to remedy the matter.

The clerk gave her a bottle of castor oil and told her to give him three tablespoons of the awful stuff and to make certain not to point him at anyone.

* * *

The Japs want to buy the glass-bottom boats from Catalina Island so they can review their fleet.

* * *

To his Negro infantry company in camp, a colored first sergeant spoke dire words: "From now on when ah blows dis here whistle, ah wants to see a huge, impenetrable cloud of dust come boilin' outa them tents. An' when 'at dust clears away, ah wants to find three rows of statues."

* * *

Want ad: For trade—One IES study lamp for good bed. Am transferring from Engineering to Arts.

* * *

The man had just saved the little boy from drowning and was being questioned by the boy's father. "Are you the man who saved little Johnnie from drowning?"

"Yes, I am."

"Well, where the hell is his hat?"

* * *

Humpty Dumpty sat on a wall
Humpty Dumpty had a great fall
All the king's horses and all the king's men
Came riding by on sidesaddles—the sissies.

* * *

Englishman: "I say, what are they doing?"

American: "Dancing."

Englishman: "They get married later, don't they?"

Commanding Officer to his rookie sergeant: "Sergeant, pick up that cadence."

Sergeant: "I didn't know I dropped it."

* * *

High school senior's theory of being a success in college:

Being able to beat the reading time in Liberty.

* * *

Recipe:

Mix 2 bottles of rum and 4 bottles of brandy. Pour in pitcher with generous supply of grapefruit and ice cubes. Stir, add bitters, sample.

Add 1 bottle of rum and 2 bottles of brandy. Pour in pitcher with grape fruit and ice cubes. Stir, sample.

Add 1 rum of two glasses and brandy. Pour in pitchers all over. Stir, steady, sample.

Add 1 sample, 2 ice cubes over bottle. Steady with stir, and sit.

* * *

"Wanna take my sister to the dance?"

"What does she look like?"

"I'll pay your expenses."

"No thanks, I got a date."

* * *

Did you hear about the two maggots necking in dead Earnest?

* * *

Unidentified: Five commandos washed, ironed, pressed. Wrapped in small, clean bundle. Please call Municipal Laundries.

* * *

An icicle is a drip that got caught in the draft.

* * *

Instructor: Mr. Johnson, what is an octogenarian?

Johnson: I don't know, but it must take a long time to become one. They're all real old people.

* * *

Here's to the ships of our navy,
Here's to the ladies of our land.
May the former be well rigged,
And the latter be well-manned.

Smoking in the barracks was strictly forbidden, but two privates sneaked away from their bunks for a puff or two in the toolhouse. As they blew blue rings into the atmosphere, the sergeant happened to pass. He stopped, sniffed the air, eyed two half-smoked fags on the ground and asked:

"Whose cigarette is that?"

"Yours," smiled the private addressed. "You saw it first!"

* * *

Advice to a Frosh Coed . . .

A close friend's okay in a tight squeeze, but don't let a fool kiss, or a kiss fool you.

* * *

And then there was the baby named Rockwool because he kept his father out of the draft.

* * *

THE WOLF SONG

If he parks his little flivver
Down beside the moonlit river
And you can feel him all a-quiver
Baby, he's a WOLF.

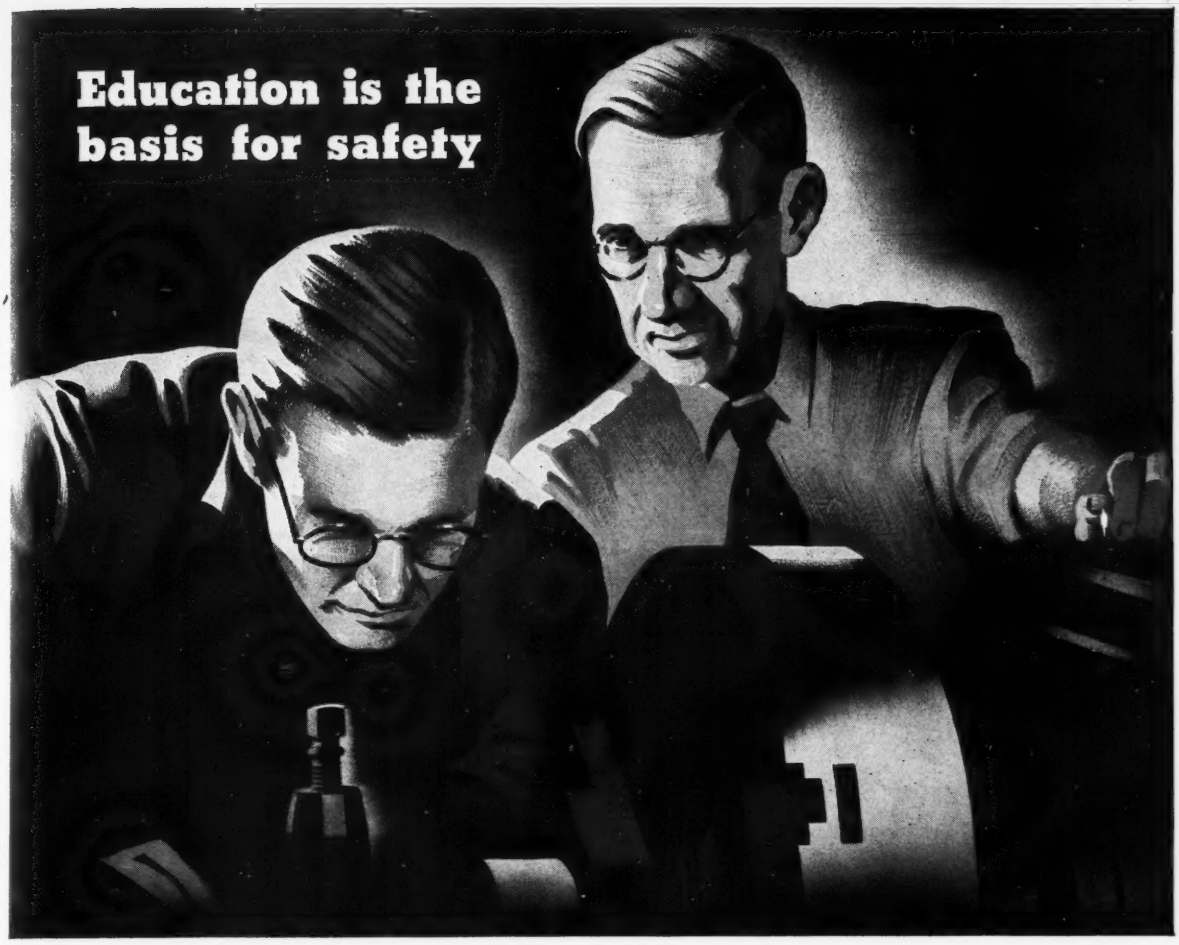
If he says your're gorgeous lookin'
And that your dark eyes set him cookin'
And your eyes aren't where he's lookin'
Baby, he's a WOLF.

When he says you are an eyeful
But his hand begins to trifle
And his heart pumps like a rifle
Baby, he's a WOLF

If by chance when you are kissin'
You can feel his heart a missin'
And you talk, but he won't listen,
Baby, he's a WOLF.

If his arms are strong like sinew
And he stirs the Gypsy in you,
So that you want him close agin' you
Baby, maybe, YOU'RE THE WOLF.

—Nebraska Blue Print



Information supplied by the National Safety Council

Labor, particularly inexperienced labor, cannot be expected to recognize the full penalties of carelessness in the shop. Management has assumed the responsibility of supervising safety measures, and has cooperated in establishing sound safety rules.

Nevertheless, the large increase in labor personnel due to war needs, plus the influx of inexperienced men, have resulted in a substantial increase in lost time accidents.

Even assuming that the obvious safety measures with regard to operating machinery, electrical equipment and shop traffic have been installed, two factors — education and eternal vigilance — determine the real effectiveness of any safety program.

Both are the responsibility of the supervisory staff, from foremen up. The foreman who does a thorough job of educating his particular group in safety rules and cooperative enforcement has done much to cut down accidents. Management that takes an active interest in both safety education and the enforcement of safety measures has taken a great step forward in reducing wastage of irreplaceable production time.

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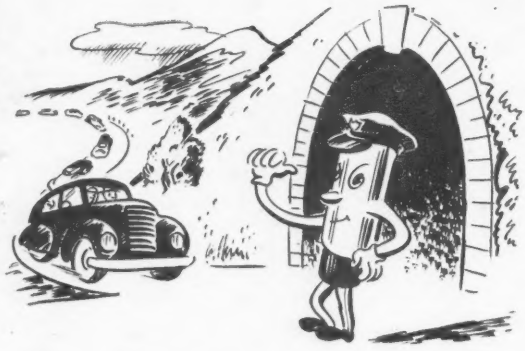


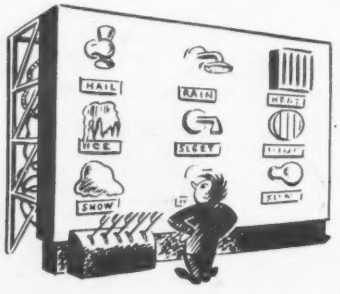
COAST IS CLEAR

FOR three years an automatic traffic control (essentially an electronic device) has been directing motorists through a one-way tunnel that serves as a direct route through a mountain on a Salt Lake County highway in Utah.

The traffic control counts vehicles as they enter and leave the tunnel. If the outgoing count is less than the ingoing, a bell warns a patrolman to go in after the missing car. Thus traffic is kept moving through the tunnel—in one direction at a time.

When the carbon-monoxide content of the air in the tunnel reaches a critical point, another electronic watchman stops traffic and turns on a ventilating fan.

Approximately 600 cars go through the tunnel every 24 hours, but the electronic cop isn't tired yet.



TAKE YOUR CHOICE

THE U.S. Army Air Force can test airplane engines at altitudes of 40,000 feet, where it's 67 below, or at low altitudes over deserts where the temperature soars to 120 F—without taking the ships from the ground.

Testing is done in a laboratory where refrigeration equipment, electric heaters, and air evacuating equipment take over for the elements.

One such lab, for which G.E. is building electrical equipment, will house several test chambers, in each of which engines will be tested under different conditions.

To accomplish this, air will be partly conditioned and then delivered to the various test chambers. At each test chamber the air will be further conditioned to obtain the exact humidity, temperature, and pressure for the particular condition desired. Then the air will be delivered to the engine carburetors.

PIPE DREAM

THE War Emergency Pipeline, largest oil trunk of its kind in the world, will go into operation in January. Extending 531 miles from Longview, Texas to Norris City, Illinois, the "Big-Inch" pipeline (so called because it is 24 inches in diameter) will help alleviate the oil shortage in the East.

G.E. recently shipped, five weeks ahead of schedule, the first two of fifteen 1500-hp motors it is building for the line.

Built of cast iron to conserve steel plate, the motors will be used to drive centrifugal pumps in booster stations along the line. These pumps will keep 1,330,000 barrels of oil flowing at a rate of 4 miles per hour—a delivery rate of 300,000 barrels a day at Norris City.

By June it is expected that the remaining section of the line, 857 miles long, will connect Norris City and the Atlantic seaboard.

GENERAL ELECTRIC

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